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USSR CIVIL AIR FLEET--PLANT AND OPERATION

Introduction

The resumption of publication of the Soviet trade journal, Grazhdanskaya Aviatsiya (Civil Aviation), in 1955 opened a flow of information of considerable dimensions. Since the Civil Aviation periodical is primarily an instrument for the training of Aeroflot personnel it contains information of current technical value and reflects the basic problems of economics, maintenance, logistics, flight scheduling and routing, etc., associated with the operation of a major airline. To be sure, the customary censorship is still in evidence, consistently withholding the direct publication of such items as administrative organization, numbers of aircraft in operation, location and strength of operational units, manpower, navigational equipment and the communication systems in actual use.

Comprehensive data on many of these subjects, however, can be obtained indirectly in conjunction with the use of the official flight schedules of the Aeroflot and a large volume of incidental information available in newspapers and periodicals.

The present report represents a systematic arrangement of materials published in the Civil Aviation periodical from January 1955 to October 1956. For illustrative purposes, operational data were derived from the 1956 Summer Flight Schedules of the Aeroflot, the derivation being based on theoretical articles in Civil Aviation. Background information from earlier sources, and data on new air routes, local flight connections, new construction, etc., published in current daily newspapers and periodicals were included to complete the comprehensive coverage of the subject.

PART I. ADMINISTRATIVE ORGANIZATION

A. GENERAL

Soviet civil aviation is operated by an organization called The Main Administration of the Civil Air Fleet, (GUGVF - Glavnoye upravleniye grazhdanskogo vozdushnogo flota).

The Main Administration exercises its authority on the local level through a number of Territorial Administrations (TU - Territorial'noye upravleniye GVF), seated in the capitals of the Republics, or other administrative centers. Territorial Administrations are, in essence, local subdivisions of the Main Administration, directing the activities of all airports and other operational units within their territorial boundaries. (68).

The airports, especially the so-called base airports are the most important operational units within a Territorial Administration. Base airports are those which serve as maintenance and operational bases for flying stock. The others are usually referred to as intermediate airports.

B. THE MAIN ADMINISTRATION OF THE CIVIL AIR FLEET

The Main Administration of the Civil Air Fleet is headed by S. F. Zhavoronkov, an Air Force Marshal in active service*. His first deputy, N. A. Zakharov, is a Lieutenant-General of the Technical Forces. The second deputy chief is Ye. M. Beletskiy, Lieutenant-General of Aviation (55, 74, 120, 219, 246, 254, 275, 305, 329).

Formally, the Main Administration is directly subordinate to the Council of Ministers of the USSR (28 etc.) but a German source states that "civil air traffic is partly under the direct command of military establishments." (25)

The Main Administration was established under that name in 1934. Since then changes and readjustments have taken place in its internal structure, as well as in the organization of the Aeroflot as a whole.**

At the present, the Main Administration of the Civil Air Fleet is divided into the following directorates, departments, and establishments.

1. Directorates (Upravleniye)

Note: Names of incumbent officials, insofar as they are available, have been included to facilitate further research. The date of tenure is indicated by the source.

Directorates are the largest subdivisions of the Main Administration. Following is a listing of directorates mentioned in the source material:

(1) Political Directorate is now headed by N. Ochnev, with the former chief being A. Letov, according to an earlier (1955) source. The directorate includes a Department of Propaganda and Agitation (Otdel propagandy i agitatsii) under V. Shaposhnikov and his deputy M. Levikov (47, 41, 49, 50, 76, 208, 214, 220).

* Around the month of February, 1957, this position was taken over by P. F. Zhigarev, an Air Force Marshal and formerly Chief of Air Force.

** The evolution of the administrative structure of the Aeroflot up to 1953 has been treated in a comprehensive report of May, 1953 on "Local Administrations of the Civil Air Fleet of the USSR" (AF 548922).

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(2) Directorate of Transport Aviation (UTA - Upravleniye Transportnoy aviatsii) under Semenov and his deputy V. M. Chernyakov. The Directorate also commands an Aeronavigational Department (Letno-shturmanskiy otdel). (60, 118, 153, 208, 307).

(3) Directorate of International Air Routes (Upravleniye mezhdunarodnykh vozdushnykh linii) under V. M. Danilychev and his deputy M. N. Khrolenko. (9, 97, 105, 275, 305).

(4) Directorate of Special Purpose Aviation and Aerial Photography (UASP i VS - Upravleniye aviatsii spetsial'nogo primeneniya i vozdushnykh s"yemok), headed by Gorbunov. Earlier sources name P. Chulkov as chief and Nazarov as his deputy. The directorate includes a Planning Department. (84, 152, 175, 203, 208).

(5) Directorate of Personnel (Upravleniye kadrov GUGVF). Inspector P. M. Gel'yashenko. (52).

(6) Directorate of Educational Institutions (Upravleniye uchebnykh zavedeniy). The directorate comprises a Department of Special Instruction (Otdel spetsial'noy podgotovki). (66, 161).

(7) Directorate of Ground Installations (Upravleniye nazemnykh sooruzheniy) under Khristyuk (126, 169).

(8) Directorate of Construction Work (Stroitel'no-montazhnoye upravleniye GVF) under Alekseyev (58, 126, 243).

(9) Medical and Health Directorate (Lechebno-sanitarnoye upravleniye) under Panov (92).

(10) Directorate of Technical Supply and Procurement (UMTS i Z- Upravleniye material'no-tekhnicheskogo snabzheniya i zakazov) under Bocharov. The directorate comprises a Supplies' Department (Veshchevoy otdel), an Aircraft Department (Samoletnyy otdel), and Materials and Spare Parts Warehouses. This directorate is specifically in charge of supplying the operational units with materials and equipment such as heaters, jackets, step ladders, washing machines etc. (84, 112, 117, 118, 119, 222).

(11) Directorate of Communications and Radio Navigation. (Upravleniye svyazi i radionavigatsii) (235).

(12) Directorate of Technical Maintenance (TRU - Remontno-tekhnicheskoye upravleniye) (60, 84, 119, 127, 178, 208).

(13) Directorate of Construction Projects ("Aeroproyekt") under M. I. Martsenitsen. (126, 191, 245).

(14) Directorate of Aviation Engineering Service (UIAS - Upravleniye inzhenerno-aviatsionnoy sluzhby) under Antonov (84, 101, 118, 169, 208, 245). This directorate has a Technical Supplies Center. (169).

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2. Departments (Otdel)

Some departments, although usually referred to as "departments of the Main Administration", may actually be subdivisions of some of the directorates listed above. Some, however, appear to be independent agencies on the same level as Directorates.

(1) Planning and Economic Department (Planovo-ekonomicheskiy otdel) of the GUGVF. This department includes a Statistical Section which performs all statistical studies concerning the Civil Air Fleet. (16, 24, 112, 214).

(2) Financial Department (Finansovyy otdel) of the GUGVF, under A. Gorshkov (222).

(3) Labor and Wages Department (Otdel truda i zarplaty) of the GUGVF (52, 73).

(4) Technical Department (Tekhnicheskiy otdel) of the GUGVF (208).

(5) Editorial and Publishing Department (Redizdat GUGVF-Redaktsionno-izdatel'skiy otdel) of the GUGVF (161, 178, 225). This department issues the monthly periodical, Civil Aviation (Grazhdanskaya Aviatsiya), supervises publishing of trade papers by the Territorial Administrations, and issues All-Union and International time tables, and other publications on civil aviation. (10, etc.).

(6) Specialist Training Department (Otdel spetspodgotovki GUGVF). This department has been reported to be "substantially weakened" as a result of recent structural changes within the Main Administration, which left the training of specialists largely to local agencies. (161).

(7) Shipping Department (Otdel perevozok), probably a subdivision of the Directorate of Transport Aviation (see above) (79).

3. Other Establishments

(1) Central Flight Control Service (TsDS - Tsentral'naya dispetcherskaya sluzhba GUGVF). Included is a subdivision, under Senior Controller Artamonov, supervising the air transport of matrices. (113, 189, 246).

(2) Central Clinical Hospital and Policlinic (Tsentral'naya klinicheskaya bol'nitsa i poliklinika GVF), comprising a Laboratory of Aviation Medicine under B. Tsyrlin, and a Functional Diagnostic Department. (106, 177).

(3) Central Aerometeorological Station (Tsentral'naya aviameteorologicheskaya stantsiya) at the Moscow Vnukovo airport. Available sources do not indicate the extent to which this station is a part of the Central Administration. (206).

(4) State Scientific Research Institute of the GVF (GosNII GVF - Gosudarstvennyy nauchno-issledovatel'skiy institut GVF). The institute includes a Department of Agricultural Aviation, headed by D.V. Kushchak. (59, 74, 119, 225).

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(5) Scientific Research Institute for Agricultural and Forestry Aviation. (Nauchno-issledovatel'skiy institut sel'sko-khozyaystvennoy i lesnoy aviatsii). (92, 240).

(6) Collegium of the Main Administration of the GVF (Kollegiya GUGVF) (92, 119, 208).

(7) Council of Technical Experts (Ekspertno-tekhnicheskiy Sovet GUGVF). Aside from its other tasks, the Council of Technical Experts approves designs for structures. (126).

(8) Central Storehouse (Tsentral'nyy sklad GUGVF) (119).

(9) Experimental Design Office (OKB - Opytnokonstruktsionnoye byuro). The administrative subordination of this establishment is not known. (194).

4. Inspectors

Top technical administrators, who may be classified as inspectors, are mentioned as follows:

(1) Chief Engineer of the GUGVF, Malyuga (92, 118, 191, 235).

(2) Chief Navigator of the GVF, B. Davydkin (571).

(3) Senior Flight Safety Inspector M. Zhigalov. It is not clear whether this positi n forms part of the Central or the Territorial Administrations, or both. (116).

(4) Physical Training Inspector Ye. Chugunov. (215).

C. TERRITORIAL ADMINISTRATIONS

1. General

Territorial Administrations (TU - Territorial'noye upravleniye) are the main local organs for directing the operations of the Aeroflot. The entire territory of the USSR is subdivided along boundaries of administrative units (republic kray, oblast', etc.) into areas convenient for the operation of airlines. The coastal areas of the Arctic Ocean, however, is not under the jurisdiction of the Aeroflot but are the special domain of the Arctic Aviation (AVIAARKTIKA) organization.

Some smaller areas, which do not warrant a full administrative apparatus, are assigned to so-called Aviation Groups which are independent units on the same level as Administrations.

The Territorial Administrations and Aviation Groups under the jurisdiction of the Aeroflot, are given below. Detailed information about individual Administrations, whenever available, is given under the proper headings; this information in most cases also includes the

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names of trade papers put out by the Administrations. These are widely-circulated periodicals which discuss professional problems of a local character. (123).

There are also Aviation Groups which are subordinate parts of Territorial Administrations. Such Aviation Groups operate local air routes and special purpose aviation units within their boundaries. Finally, there are a number of Republican Administrations within certain larger Territorial Administrations, probably created as a concession to local nationalism. In such cases the Republican Administration partly shares the functions of the Territorial Administration in operating nation-wide routes. (31).

2. Listing of Administrations

(1) Moscow Administration of Transport Aviation (MUTA). Administrative center: Moscow. Chief Engineer: G. V. Voytsekhovich. Trade paper: "Vozdushnyy Reys" (Air Trip).

Subordinated to the Moscow MUTA Administration, or possibly directly to the Main Administration of the GVF, is the Moscow Separate Group of Special Purpose and Aerial Photography Aviation (Moskovskaya otdel'naya aviagruppa spetsprimeneniya i vozdushnykh s"yemok). Chief: Trutayev. (31, 51, 180, 199, 209, 221, 222, 236).

(2) West Siberian (ZSTU). Administrative center: Novosibirsk. Chief: Tykov. Chief Engineer: Sukharnikov. Chief of the Traffic Service: Vorontsov. Trade paper: "Kryl'ya Sovetov" (Wings of the Soviets). (10, 59, 118, 170, 191, 222).

Subordinated to the West Siberian Administration are the Ural Aviation Group (Chief Engineer: Andriyevskiy (199), and the Sverdlovsk Aviation Group (41).

(3) Krasnoyarsk TU. Administrative center: Krasnoyarsk. Chief: Vasil'yev. Deputy Chief of Political Department: Zatupenko. (10, 58, 59, 221).

(4) East Siberian TU. Administrative center: Irkutsk. Chief: Filanovskiy. Deputy Chief: Sharov. (10, 58, 222, 234, 239).

Subordinated to the East Siberian Administration is the Yakutsk Aviation Group. The Yakutsk Group was recently formed to replace the independent Yakutsk Territorial Administration. (287b).

(5) Far Eastern TU. Administrative center: Khabarovsk. Chief: Yezerskiy. Chief Engineer: Kovalev. (10, 59, 131, 169, 222, 235, 250).

(6) Yakutsk TU. Administrative center: Yakutsk. It has been reported that the Yakutsk Territorial Administration was dissolved in 1956 or early 1957, and reorganized as Yakutsk Aviation Group subordinated to East Siberian Territorial Administration. This measure, however, is said to have resulted in inferior service to remote areas of Yakutiya. In February 1947, at the session of the Supreme Soviet, the delegate, V. Kh. Vyrdylin, from Bulunskiy rayon electoral district demanded the reestablishment of the Yakutsk Territorial Administration. (287b).

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(7) Central Asia TU. Administrative center: Tashkent. Senior Engineer for Special Purpose Aviation: V. M. Rubo. (10, 240, 311).

Subordinated to the Central Asia Administration are two republican subdivisions: The Tadzhik Aviation Group with its administrative center at Stalinabad (51, 190, 199, 299, 301), and the Uzbek Territorial Administration with its center at Ashkhabad (312).

(8) Kazakh TU. Administrative center: Alma-Ata. Chief: Sedlyarevich. (10, 47, 49, 59, 169, 209).

(9) Volga TU. Administrative center: Kuybyshev. Chief: Rasskazov. Senior Engineer of Special Purpose Aviation: I. Babichev. (10, 59, 131, 203, 222).

(10) North Caucasian TU. Administrative center: Rostov. Chief of Political Department: M. Kukharev. Chief Engineer of Special Purpose Aviation: M. N. Kunashov. Trade paper: "Vozdushnyy Put'" (Air Travel). (10, 47, 56, 74, 122, 222).

(11) Azerbaydzhan TU. Administrative center: Baku. (10, 213, 222).

(12) Georgian TU. Administrative center: Tbilisi (10).

(13) Armenian Separate Aviation Group. Administrative center: Yerevan (10).

The Azerbaydzhan and Georgian Administrations, and the Armenian Separate Group, appear to be the component parts of the former Transcaucasian Territorial Administration, which has not been mentioned in any source since July, 1955. (10).

(14) Ukrainian TU. Administrative center: Kiyev. Chief: Bebeshko. Chief Engineer: Savel'yev. Deputy Chief of Political Department: A. Nikitin. Trade Paper: "Kryl'ya Ukrainy" (Wings of the Ukraine). (10, 106, 112, 136, 170, 218, 222).

(15) Western TU. Administrative center: Minsk. Chief: Gorbunov. Chief Engineer: Mordachev. (10, 72, 83, 131, 144, 175, 181, 246).

(16) Northern TU. Administrative center: Leningrad. Chief: Zolotov. Deputy Chief in Charge of Ground Services: V. Leonovich. Chief of Department of Special Purpose Aviation: Nikolayenko. Chief of Political Department: G. Vorontsov. (10, 108, 121, 137, 169, 216).

3. Organizational Pattern of Territorial Administrations

The chief of an Administration has several deputies:

(1) Political deputy, was also head of the Political Department;
(2) Deputy for Ground Services;
(3) Chief Engineer of the Administration;
(4) Senior Engineer for Special Purpose Aviation;
(5) Chief Bookkeeper. (72, 74, 203, 216, 222, 235, 240, 307).

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A typical Territorial Administration is subdivided into following departments:

(1) Political Department (Politicheskiy otdel). (49, 56, 101, 122, 137, 144, 208, 221, 250).

(2) Planning Department (Planovoy otdel). (164).

(3) Transportation Department (Otdel perevozok). (79).

(4) Navigation Department (Shturmanskaya sluzhba, or letno-shturmanskiy otdel). (31, 182).

(5) Department of Ground Installations and Equipment (Otdel zemnogo oborudovaniya). (234).

(6) Technical Supplies Department (Otdel material'no-tekhnicheskogo snabzheniya). (222, 250).

(7) Department of Aviation Engineering Services (Otdel inzhenerno-aviatsionnoy sluzhby). (136).

(8) Department of Special Purpose Aviation (Otdel spetsprimeneniya). (121, 299).

(9) Medical and Health Service (Medsansluzhba). (106).

(10) Traffic Service (Sluzhba dvizheniya) (59).

(11) Ground Services (Nazemnyye sluzhby) (216).

(12) Production and Technical Council (Proizvodstvenno-tekhnicheskiy sovet upravleniya). (101, 218).

D. OPERATIONAL UNITS

1. General

The subordinate organs of a Territorial Administration - actually carrying out all the operations of civil aviation - are the so called operational units (ekspluatstsionnoye podrazdeleniye GVF). (68)

These operational units are usually organized as follows: (a) Airport (base and intermediate) Units, (b) Flight Transportation Units, (c) Local and Special Purpose Aviation Units, (d) Airline Maintenance and Repair Units (Workshops), (e) Aircraft Repair Bases, (f) Training Units, (g) Construction Units, (28, 81, 146).

There are also supplementary units or establishments such as Airline Agencies in Cities and Aviation Meteorological Stations.

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2. Airports

Airports are the basic operational units within the Territorial Administrations. A distinction is made between two types of airports: base and intermediate airports. (92, 183).

Base airports comprise one or more operational units, each of which has a certain flying stock permanently assigned to it to operate certain air routes or carry out special-purpose assignments. Base airports have also ground facilities for parking and storage of aircraft and workshops for regulation maintenance and repairs, etc. (183).

Intermediate airports lack some or most of the facilities of the base airports, although their equipment may vary considerably from one locality to another, according to their relative importance. (183).

The personnel of an airport is generally divided into two large groups: the flight and the ground personnel. The personnel and facilities of the airport and its subdivisions constitute the "aviation garrison" of the locality. (48, 67, 128, 177).

Listed in the 1956 summer flight schedules are some 120 domestic airports.* Of these, 18 airports constitute the administrative centers of Territorial Administrations or Aviation Groups. In addition to these, a number of other important air traffic centers (such as Khar'kov, Kazan', Gor'kiy, Sverdlovsk, Stalingrad, Krasnodar, Voronezh, Penza, and Omsk) may fall into the category of "first class" airports, which have facilities for maintenance and overhaul, and are equipped with the "most up-to-date radio installations". (10, 250).

The 120 airports, included in the summer, 1956, All-Union schedules, are only a part of the total number of airports existing in the USSR. In Appendix No. 2 a supplementary list is given, which includes airports or airfields mentioned in connection with local** airlines, and those which were previously included in the network All-Union air routes.**

Considering the general drive toward expansion in Soviet air transportation, it is reasonable to assume that none of these airports have been actually abandoned. Mention of these subsidiary airports is rare, however, due to Soviet censorship and the scarcity of source materials on local air connections. According to a German source, the total number of airfields in the USSR is about 700 (25).

A first-class Base Airport, according to available information, has an administration, which consists of the following elements, subordinated to a chief:

(a) Shipping Department (Otdel perevozok) (48, 79, 168, 177, 248).

(b) Department of Ground Facilities and Equipment (Otdel zemnogo oborudovaniya) (68, 182).

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*See list, Appendix No. 1.
**See Part II, section - C-3.

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(c) Air Traffic Service (Sluzhba dvizheniya) (48, 168).

(d) Supply Service (Sluzhba snabzheniya) (235).

(e) Flight Safety Inspektor (Inspektor po bezopasnost: poletov) (159).

(f) Flight Controller (Rukovoditel' poletov) (59, 135, 157).

(g) Chief Engineer (Glavnyy inzhener) (221).

(i) Senior Engineer for Special Purpose Aviation (Starshiy inzhener po spetsprimeneniyam). (165)

Most of these services, except for the Air Traffic Service, fall into the category of Ground Services (Nazemnyye sluzhby).

3. Transportation Units

Transportation (flight) units subordinated to airports are considered the basic units of the Aeroflot. They have permanently-allocated flying stock and crews for operating certain routes or conducting regular flights assigned to them. (62, 81, 146, 183).

The size, number and location of these units are kept strictly secret. They are identified in publications only by the name of its commander, and/or by the Territorial Administration to which they belong. Some idea of the size of an flight unit can be derived from a statement in an article dealing with the organization of flights: "If, for instance, a unit consists of only 40 crews"... It appears from this expression, that a unit comprising 40 crews is considered a relatively small unit. Another statement supporting the assumption says that "several dozens of sportsmen were participating in the "spartakiada" (sports meeting) of a unit" (79, 197).

The commander of a unit regularly issues general orders. The position of the Deputy Commander of a unit had been abolished prior to or in 1955. The Administration, or the "staff" of the unit keeps records concerning regulation maintenance, also prepares flight assignments for each crew and keeps a record of the number of accident-free flights a crew has made. (62, 197).

The staff of a basic unit, such as a flight unit, consists, aside from the Commander, of at least following elements:

Chief of the Units Staff (Nachal'nik shtaba podrazdeleniya). The special duty of the Chief of Staff is to keep a record of reprimands, punishments, commendations and incidents. (62).

Deputy Chief of Staff (Pomoshchnik nachal'nika shtaba). The special duty of the Deputy Chief of Staff is to keep a record of flight hours for each crew and make sure that the number of flight hours assigned each man does not exceed medical limitations. (62, 162).

Deputy Commander for Political Affairs (Zamestitel' Komandira podrazdeleniya po politicheskoy chasti).(67, 78, 160, 210, 225, 248).

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Political Department (Politotdel podrazdeleniya), usually under the Deputy Commander for Political Affairs. (41, 78).

Deputy Commander For Flight Service (Zamestitel' komandira podrazdeleniya po letnoy sluzhbe). (62, 65, 114, 197).

Senior Navigator (Starshiy Shturman). (62, 148).

Aviation Engineering Service (inzhenerno-aviatsionnaya sluzhba podrazdeleniya). (136).

Senior Engineer (Starshiy inzhener podrazdeleniya). (62, 136).

Senior Engineer for Special Purpose Aviation (Starshiy inzhener po spetsprimeneniyam). (231).

Pilot Instructor (Pilot-instruktor podrazdeleniya). (115).

Physical Training Instructor (Instruktor po fizkul'ture). (197).

Chief of Communications (Nachal'nik svyazi podrazdeleniya). (62).

Recording Technician (Tekhnik po uchetu). The Recording Technician keeps a record of the regularity of flights, which is submitted monthly and quarterly. (62).

Secretary (Deloproizvoditel'). (62).

Technical Production Councils (Proizvodstvenno-tekhnicheskiy sovet) have been introduced in a number of units in order to encourage personnel to submit and introduce efficiency suggestions. (170, 208).

4. Local and Special Purpose Aviation Units

These units are equipped with flying stock for operation of feeder routes or for carrying out various special purpose assignments within (and occasionally outside of) their areas. The organization of a unit differs according to its function, agricultural, forest, medical, etc. (183).

Special purpose aviation units are often subdivided, especially on agricultural assignments, into so-called flights (zveno). These consist of several aircraft and crews who will cooperate closely in carrying out an assignment. (134, 196).

One of these units is known to be located in Moscow; it is the Moscow Unit of Special Purpose and Aerial Photography Aviation. Another is located in Dnepropetrovsk. A Forest Fire Protection Base is known to operate in Molotov. A medical aviation unit is, according to sources, stationed in Odessa. (98, 99, 106, 134).

The total number of these units, as well as their location, is not known. The (administrative) staff of a Special Purpose Aviation unit comprises, besides the commander, a Senior Engineer for Special Purpose Aviation (61). No information is available concerning other elements of the staff.

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5. Airline Maintenance and Repair Workshops

Regulation maintenance and overhaul of operating aircraft is carried out at a number of Airline Maintenance and Repair Workshops (LERM). (28, 81, 146, 209).

At least one such workshop is known to exist in every airport at the administrative center of a Territorial Administration.* In addition, a LERM is known to exist in the Yakutsk airport. The administration of a LERM is staffed by the following officials under a chief: (107, 250, 236).

Deputy Chief for Political Affairs (Zamestitel nachal'niko LERM po politicheskoy chasti). (63).

Chief Engineer (Glavnyy inzhener LERM) (64, 198).

Senior Engineer (Starshiy inzhener LERM) (198).

A LERM is subdivided into shops (tsekh), directed by a chief and a deputy for political affairs. The shops are subdivided into specialized workshops under foremen. (94).

6. Aircraft Repair Bases

These establishments (the ARB - Aviaremontnaya baza) carry out heavy repair work. (28, 81, 77, 127, 146, 147, 155, 157, 163, 210).

Relatively little is known about the number, location, and capability of the Repair Bases, although the LERM are usually identified by their location. Pertinent data concerning the ARB is consistently withheld. One of these bases is definitely located in Kiyev and is considered "one of the best in the Aeroflot". It specializes in passenger aircraft. The most modern repair techniques (such as flow line dismantling and assembly of engines) has already been introduced in this establishment. It commands a well-equipped testing laboratory. (See photos, Figs. 4 and 6). Another Repair Base has been associated with Alma-Ata airport, and is headed by V. Borodavkin. It is also referred to as an "repair establishment". The third Repair Base is known to be situated somewhere in Stavropol' oblast. Frequent use of the expression "repair establishment", identified only by the name of its chief, and in context where the LERM as well as the ARB can be meant, suggests the possibility of a type of combined establishment, where a LERM is extended to also perform heavy repairs. A number of the LERM, in fact, are known to have a special shop for "heavy repair". Among these are the Moscow-Vnukovo and Moscow Bykovo LERM, and those in Rostov and Novosibirsk. (247). (See Figs. 8, 9).

Along with the stationary repair establishments, mobile repair shops (PARM - Peredvizhnaya aviaremontnaya masterskaya) are available in some areas. (181).

* A comprehensive report on the LERM has been prepared in 1956, AF No. 717689.

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Practically no information is available on the administrative staff of a repair base, or a "repair establishment".

7. Training Units

The Training Units (Uchebno-trenirovochnoye podrazdeleniye) are engaged in introductory and refresher training of pilots and specialists. Their units are subordinated to the Territorial Administrations and are sometimes assigned operational tasks. A closer link, however, is advocated with the Training Directorate of the GUGVF. (100, 161, 195, 213).

Training units are known to exit in Baku (headed by V. Nikitin), in Krivoy Rog (144, 212) and probably in all Territorial Administrations.

8. Construction Units

Construction units (Stroitel'noye podrazdeleniye) carry out building and construction work for the Aeroflot. Little is known about their number and geographical distribution. It is possible that they move from place to place, according to work assignments, and operate under the direction of the Main Administration. (183, 209).

9. Various Establishments on the Unit Level

The above types of operational units may be regarded as basic. Aside from these, supplementary units, such as airlines offices in cities (Gorodskoy agentstvo), Aviation Meteorological Units or Stations (Podrozdeleniye Aviameteorologicheskaya), and Pre-flight Health Units (Profilaktoriy), are maintained at airports. (92, 162, 206, 223).

Finally, there are temporary or seasonal units of task force type, used particularly in Special Purpose Aviation for carrying out special assignments in the agriculture, fishing or geological research.

Special bases are established for aerial photography, probably in conveniently-located airports, from which aerophotographic groups are dispatched to areas under study. (153).

E. POLITICAL, TRADE-UNION AND KOMSOMOL ORGANIZATIONS. DOSAAF.

1. General

Parallel to the administrative and technical hierarchy of the Aeroflot, four other organizational structures exist to insure its satisfactory operation: (a) Political organs within the main and territorial administrations, (b) the Party, (c) the Trade Union and (d) the Komsomol organizations. These political organizations follow the general administrative pattern, following closely the example of the Armed Forces in regards to political supervision. In the case of

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Aeroflot this control is supplemented by the fact that Trade Union and the Komsomol organizations penetrate all administrative levels down to the smallest work teams and even the individual worker. (42).

Party organs within the administrations, as well as Party, Komsomol, and Trade Union organizations, are obliged "to spur the struggle against flight accidents, to reveal and eliminate the slightest violations of flight regulations. The first duty of political workers is to associate themselves with the people, and personally conduct group as well as individual work". (29).

The members of administrative political organs, in particular, have the duty to "teach the secretaries of party and Komsomol organizations, propagandists, wall-newspaper editors, etc., how to conduct mass political work." They must perform these functions with the aim of solving two main problems -- fulfillment of the plan and insuring flight safety". (29).

The deputy chiefs for political affairs are personally responsible for the quality of Party, Komsomol and Trade Union activities. Chiefs and commanders who fail to seek the support of Party, Komsomol and Trade Union organizations in order to restore order and discipline, share the responsibility. (29).

2. Political Organs of Administrations

The administrations of all organizational units comprise, as shown above, special organs (directorates, departments) for political management. A deputy chief (deputy commanders) for political affairs is, as a rule, the head of the political organ (directorate, department) within an administration. (250).

The staff of political organs consists, in essence, of Party members, who are regular salaried Aeroflot officials. Most of the staff members act as inspectors, propagandists, or "lecturers" on various subjects and problems which are regarded as requiring "political" treatment. (49).

The Political Department of the Kazakh Territorial Administration, for instance, has 25 qualified propagandists in its "lecturers group"; more than 500 propagandists are employed in lecturers groups of all Territorial Administrations and Aviation Groups. These propagandists are aided by a considerable number of lecturers enlisted from among Communists not on the staff of political organs. (49).

The aim of all political indoctrination or "enlightenment", as it is officially called, is to improve the morale of civil aviation employees, with the practical purpose of increasing efficiency and productivity. In the Aeroflot these practical ends of political propaganda are repeatedly designated as "safety, regularity and low cost of air transportation." "Political as well as other organizations must educate the personnel in the spirit of intolerance for uneconomical practices, low labor productivity, and violations of work norms and state discipline". (29, 41, 131).

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This is necessary, to combat "the mutual agreements to overlook shortcomings", which is the tendency of technicians and even of Communists themselves. The situation is illustrated by a number of cases of covering up flight accidents occuring within a certain unit. (137).

One of the main instruments for solving the problems of economy and productivity is considered to be "continuous instruction in Marxist-Leninist science" given by the political organs and Party organizations to technical managers. "The experience of socialist reconstruction teaches, that only a manager constantly perfecting his understanding of Marxism-Leninism, can correctly solve the problems he encounters." "Political instructions has a beneficial influence on production." This statement is corroborated even by numerical data. (41, 131).

Aside from lectures, the political organs use many other means to further their objectives. Periodicals are circulated by the Central Administration as well as by the Territorial Administrations. Books and pamphlets are issued in large number for distribution to subordinate units.* Party libraries, stocked with political propaganda literature, exist in all units; these libraries are centers for propaganda activities where lectures, meetings, exhibitions, discussions, and individual and group consultations are organized. (41).

Regular daily, weekly, monthly and quarterly meetings of various groups of administrative and technical personnel as well as of political workers themselves, are held under the supervision of political organs, with the purpose of providing a forum for criticism and the issuance of new instructions. The aim is to involve every member of the group by varying educational methods. (42).

The most significant instrument to insure successful operation of Soviet civil aviation is the recently introduced "Disciplinary Code of the GVF", which gives supervisors the power to punish their subordinates very much on the same lines as is usual in the armed forces. (108).

3. Party Organizations

All communists within the Aeroflot are organized according to its administrative units and subdivisions. Every administration, airport, or operational unit includes a party organization, headed by a committee and a secretary. A party office (partbyuro) is maintained in larger units. These organizations are the instruments of the political organs in carrying out their directives and assignments "from within". The party organization is assigned "the leading and organizing role in the education and training of the personnel". (42, 76).

*) Lately, following pamphlets and collections of articles have been issued by the Political Directorate of the Central Administration: "Experiences of the Work of Party Groups", "Experiences of Mass Propaganda Work", "Some Experiences of the Work of Komsomol Organizations", "Party and Political Propaganda in the Operational Units of the GVF", etc. (220).

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Actual political indoctrination, along with the direction of socialist competition, is centered in the operational units. The main form of these activities are the party organization meetings taking place at least once a month. Here "important problems" in the work of the unit are discussed, and directives given for further Party work. Trade-union and Komsomol members, as well as representatives of the municipal Party local, often participate in these meetings.* (29, 42).

The directives of Party conferences are promulgated at various types of periodically held conferences of different groups of the personnel. One of the most common types is the so-called "production conference", which is, in essence, a hearing on production output, followed by an "evaluation" and directives for improvement. Other means include discussions, readings, analyses of the day's output and of socialist competition, exchange of experience, work with individuals members of the collective. (29, 42).

In some units, every work day ends with a production conference. Advanced workers, as well as the "laggards" and the "violators of discipline" are questioned at these conferences. All units must keep records of their daily output. (42).

Crew conferences are held in flight units once weekly, to review performance. Deficiencies are discussed and their causes analyzed at these meetings. Since, however, "experience has shown that in flight the crews are outside the sphere of Party influence, (the escape starting already on the eve of the departure with the overnight stay in the pre-flight medical check-up stations or in the airport hotel)", in some cases "political measures" are extended even to these places, by sending political workers to "organize proper pre-flight rest for all members of crews." In some exemplary units the political workers are so stationed that every crew has "at least one militant Communist among its members. Wherever such a crew happens to be, there are always classes, discussions, information conferences, newspaper readings etc." (29).

Still other means of stepping up the morale of the workers are the wall-newspapers, of which there are several types. In one unit (Kirensk), three different types of wall-newspapers are used along with the standard "Molniya" (Lightning) type. Other examples are a cartoon series projected on a screen and accompanied by commentaries and limericks read through a microphone, a pictorial newspaper called "The Work Day of the Unit" showing the advanced workers at work, and a technical paper called "Samolet" (Aircraft). Each of these papers is issued once or twice a month. Political information is issued systematically, twice a week; once to various service groups, and once at the general meeting of the personnel. International and domestic problems, as well as some aspects of the activities of the unit are discussed at these meetings. "We have achieved the condition, where every violation of a regulation or discipline is made subject of a conference discussion". (42).

* In a seminar of political deputies of unit commanders and secretaries of primary party organizations' in the Western Territorial Administrations in early 1956, lectures were delivered such as "On the control of the Administrative Activity", "Control and Execution of a Party Decision" etc.

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Personnel, other than members of the Party, are also encouraged to participate in lecturing and discussions. Their appearance, however, is preceded by much consultation and "help" from the party workers. There is, however, a tendency to reduce the multiplicity of clubs and schools, so as to permit to pay more attention to the quality of instruction. (41).

Annual meetings of the party organizations serve the purpose of hearing the reports and reelecting the functionaries. There, the activities of Party members in their unit are submitted to severe criticism as prescribed by the higher party authorities. When the things threaten to get out of hand, the annual meetings are often summoned ahead of time; as happened, for instance, in 1956 in the Western Territorial Administration. The meeting resulted in a general reshuffle of the administrative staff, sending out political trouble-shooters to check the actual conditions on the spot, organizing special "Commissions for Public Regulation of the Productinn", establishing Komsomol watchdogs to check on the consumption of materials and spare parts, and sending technical workers to other units to learn better work methods. (251).

The "Marxist education" of leaders in Aeroflot is said to be largely improved. In some Moscow units, nearly all the administrative personnel is studying in the Marxist-Leninst Night University, which has 1800 Aeroflot employees among its students. The Party Night Schools have 300 students from the Aeroflot. Furthermore, many workers are independently studying political economics and participating in seminars. The Northern, North-Caucasian, Ukrainian and Moscow Territorial Administrations and the Sverdlov Aviation Group are praised as the most advanced in terms of number of personnel engaged in political studies. (41).

4. Komsomol Organizations

The most active assistants to the Party organizations are the Young Communist or Komsomol groups, which embrace all the former or present members of the organization within the Aeroflot. The Komsomol follows the pattern of the Party organizations. In each administrative or operational unit there are Komsomol Committees, under the direction of a secretary. Besides fulfilling the assignments of party functionaries, the specific task of the Komsomol organizations is "to strive for education of the youth in the spirit of conscious discipline". (42).

Their work very much resembles that of Party organizations, and consists of meetings, conferences, lecturers and discussions on subjects related to youth activities. Occasionally the Komsomol members are used as "shock" trouble-shooter teams for "restoring order" in critical areas. (42, 251).

5. Trade-union Organizations

All professional and technical employees of the Aeroflot are members of the All-Union Trade-union of Aviation Workers (Vsesoyuznyy profsoyuz aviarabotnikov). This organization embraces the great majority of the production personnel, and, being wholly under Party control, is instrumental in solving predominantly technical and production problems,

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although even here the educational aspect is often in the foreground. The organization is headed by the Central Committee, the presidium of which is the top executive organ. Since 1955 the president of the Central Committee has been A. F. Zhuravlev. D. Goncharenok is one of the members of the presidium. (42, 43, 60, 93, 129, 169).

The Central Committee has several departments, of which only the Recreational Department (Kul'turno-bytovoy otdel) under Islent'yev is known by name. (129).

All administrative and operational units have their local committees, headed by a secretary. The local committees are designated not according to administrative units, but by the republics, territories and localities to which the administrative subdivisions belong. (93, 110, 154).

The Trade-union organizations are held responsible for everything pertaining to actual performance, i.e. for all deficiencies occuring in the professional sphere. The VII Congress of Aviation Workers Trade-union, held March 22-24, 1956, in Moscow, criticized the local organizations for not having done enough in such fields as reduction of flight accidents, improvement of passenger service, supply of materials and spare parts, elimination of lags in fulfilling of plans, raising labor productivity and improving safety measures and working conditions. Trade-unions were even blamed for the inadequate training of pilots and technicians. (169).

A special task of Trade-unions is the organization and supervision of socialist competition among units and professional groups. The main burden of introducing new aircraft, equipment, work methods and labor organization is put on the Trade Union organizations. Thus, for instance, the introduction of flying with relay crews, and the recent cut in aircraft crews (elimination of flight mechanics), is to a large extent their responsibility. Last but not least, the Chief of Aeroflot Zhavaronkov recently stressed the paramount importance of educational work to be done by the Trade-unions among the personnel, particularly with the aim of increasing flight safety. (93, 169).

The VII Congress of Trade-unions discussed and approved the Code for the Aviation Workers' Trade-union (Ustav profsoyuza aviarabotnikov), which is to be a general directive for the organization's activities. (169).

The actual performance of the Trade-union organizations resembles in essence that of the Party and the Komsomol. Meetings, conferences, discussions, lectures, periodical or occasional, appear to be the main method of "work", although something is also done in the actual production work. (42).

6. DOSAAF (Society for Promotion of the Armed Forces)

Many of the Aeroflot workers and employees are members of the DOSAAF (DOSAAF -- Dobrovol'noye obshchestvo sodeystviya, armii, aviatsii i flotu). Although the Society is officially "voluntary", in reality all Aeroflot members are put under pressure to join it. By means of this organization the bulk of Aeroflot personnel is kept in constant

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contact with the Armed Forces. This prepares them for military duties and facilitates the actual transfer when needed. (39).

An idea of the scope of the activities of the DOSAAF can be derived from following data. In June 1956, on the occasion of Aviation Day, more than 45 primary DOSAAF organizatinns in Ashkhabad, the capital of the Turkmen SSR, organized lecture meetings. (325).

Comparable figures for other locations are not available. But some figures suggest the very large scope of DOSAAF activities in the Aeroflot.

The system of triple political control of the administration and plant of the Aeroflot, is considered a necessity under the Soviet system. In fact, its effect is not necessarily beneficial: it creates a chaotic mesh of contradictory relationships, where an administrative boss is often under the political supervision of his subordinates. The limits of responsibilities are utterly confused. There are many opportunities to shift responsibility, but also unpredictable chances to be made responsible for something which is largely under the control of others. Much criticism is made about specific situations, blaming bureaucractic methods, red tape, lack of responsibility, etc. on the part of individual managers, political or administrative. But the critics consistently avoid attacking the system as a whole. (29, 41, 84, 112, 136, 137, 170, 202, 225).

F. INSTITUTIONS AND SCHOOLS

1. Institutions

The Central Administration of the GVF maintains special institutions for scientific research and development of aviation equipment. The most important of them is the State Scientific Research Institute of the GVF (Gos NII GVF -- Gosudarstvennyy nauchno-issledovatel'skiy institut GVF) in Moscow. This establishment was formed by combining several separate institutions, founded during the First Five-year Plan period, 1928-1932, for development of aviation equipment, such as engines, airframes, auxilary devices, fuels, etc. (1).

The Institution carries on large-scale research and development activities. Every new type of aircraft goes through the testing laboratories of the Gos NII before it is put into operation. The instructions and operational manuals are prepared by the Institute. It also develops and improves a large variety of auxiliary apparatus for aircraft and airways. The Institute has a flight test department and an airfield. (194).

Another research establishment is known under the name of Scientific Research Institute for Agricultural and Forestry Aviation (Nauchno-issledovatel'skiy institut sel'skokhozyaystvennoy i lesnoy aviatsii). Its location is unknown. It is possible that it is part of the Gos NII. (240).

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2. Higher Aviation Schools

The Directorate of Educational Institutions of the Main Administration of GVF supervises a number of schools for training aviators, engineers, economists etc. for civil aviation. (243).

Among higher institutions of this kind, the following are known:

(1) The Leningrad Aviation Institute, established in 1930, now probably the main part of a complex of educational institutions known as the "Leningrad Group of Educational Establishments of Civil Aviation. (1).

The Institute includes the Higher Aviation School of the GVF. The establishment of new departments for preparation of specialists for airport shipping departments has been urged recently. (205, 229).

(2) Moscow Institute for Airship Construction. Established in 1934. This institute, however, has not been mentioned in any connection during the last few years. (1).

(3) Kiyev Civil Aviation Institute "K. Ye. Voroshilov." Established in 1933. A new classroom building was under construction in January 1956. The Kiyev Aviation Institute is located near the Kiyev airport. It is famed for its strong corps of professors and teachers. (1, 101, 126, 136, 151, 206, 209, 218).

The Kiyev Institute of Aviation Engineering of the GVF has been mentioned once. It may be that this is just an inexact name for the Kiyev Aviation Institute. On the other hand, an Institute of Aviation Engineering of unknown location is definitely known to have a department of correspondence studies, the person enrolled in this course being an employee of the Moscow-Bykovo airport. (197, 224)

Further, a School of Advanced Pilotage (Shkola vysshey letnoy podgotovki) exists at some unknown place. Its task is the training of aircraft commanders. (110, 182, 219).

The Aviation Medicine Section of the Moscow Society of Physiologists is an organization of scientists and medical men of the Air Force, Civil Aviation and DOSAAF, in which aviators participate. Lectures on pre-flight medical examination, aviation physiology and psychology, the history of aviation medicine etc., are delivered. Special problems such as that of night vision, or the physiological effect of acceleration, are also discussed. (190)

3. Intermediate-level Aviation Schools

(1) Sasovo Flying School of the GVF, located on the river Tsna, Ryazanskaya oblast'. This school has long been widely known. Almost every unit of the Aeroflot includes some of its graduates, trained engaged in various specialties. Some criticism has been published concerning the level of theoretical instruction on aircraft engines and piloting instruction at the school. The school has several airfields, but most of them, especially the central one, are in poor condition. There is a shortage of flying apparel and footwear for

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students. Complaints about food and canteen service of the Voyentorg (Military Canteen Service) are frequent. The school has a stadium, now under construction (October '56). F. Strelkovskiy is the Chief of Staff of the School. Chief of Political Department is A. Vorontsoy. (197, 243, 250).

(2) Buguruslan Flying School of the GVF, is located in the petroleum-producing town of Buguruslan, on the river Bol'shaya Kinel' in the Trans-Volga region. This is another widely-known school, with its students working in nearly every Aeroflot operational unit. (144, 206, 240, 244, 255).

(3) Yegor'yevsk Flying School of the GVF, is located in the rayon center of the same name, Moscow oblast'. No details are available. (154, 250).

(4) Krivorozhskoye Flying School of the GVF, is in the town of Krivoy Rog, Dnepropetrovskaya oblast', Ukraine. No details available. (144, 250).

(5) Krasnokutskoye Flying School of the GVF, is in the town of Krasnyy Kut, Saratovskaya oblast'. Since there is also a settlement named Krasnyy Kut in the Voroshilogradskaya oblast', the true location of the school is uncertain. No further details available. (250).

(6) Irkutsk Flying School of the GVF, is in the city of Irkutsk. No further details available. (250)

(7) Rizhskoye Aviation School of the GVF, is in the city of Riga, the capital of Latvian SSR. No details available. (136).

(8) Alma-Atinskoye Aviation School of the GVF, is in the city of Alma-Ata, capital of the Kazakh SSR. Its address in 1952 was: 16, Ulitsa Vos'mogo Marta. No further details available. (293).

(9) Troitskoye Technical Aviation School of the GVF, is in the town of Troitsk. Inspektor: S. Yusupov. Since there are about half a dozen settlements named Troitsk, the location of school can not at present be assertained.

(10) Gor'kovskiy Aviation Technical School of the GVF, in the city of Gor'kiy, has been known since 1934, when it began training production technicians. No further details are available. (1, 240).

In addition to the above listing, there are other schools known to be active in 1934, but not mentioned later. Some of them may have been turned over to the Air Force. These schools are:

(11) Leningradskoye Technical Aviation School of the GVF for operational technicians in Leningrad (1). It is probably a part of the Leningrad Group of Educational Establishments of the GVF.

(12) Kiyevskoye Aviation Technical School of the GVF for operational technicians. (1).

(13) Saratovskoye Aviation Technical School of the GVF for operational technicians. (1).

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(14) Moskovskoye Technical Aviation School of the GVF for special services technicians. (1).

(15) Bataysk Groups of Aviation Schools is in the town of Bataysk, Rostovskaya oblast'. (1)

(16) Tambov Group of Aviation Schools is in Tambov, the oblast' capital. (1).

(17) Balashov Group of Aviation Schools is in Balashov, the oblast' capital. (1).

According to a 1934 source the Bataysk, Tambov, and Galashov Groups of Schools were training pilots as well as aviation technicians. Each school had auditoriums, laboratories, workshops, training airfields, repair plants, hangars, dormitories, bathhouses, laundries, etc. The schools had their own aircraft. The schools were built on wasteland, fields or in the steppe. Their pattern of organization followed that of analogous establishments in the Air Force, which is typcial of the general semi-military organizational pattern of the entire Aeroflot. (1).

(157)

(18) Radio Operation School of the GVF. / Location and details not known. Probably it is a part of Moscow or Leningrad Groups of Educational Establishments.

All expenses of operating these schools, including tuition, food, lodging and clothing of the students, are met by the State. This is said to be one of the reasons for the low level of flying skill of students graduated from these schools. It is felt to be economically unsound, to expell the students after they have studied for 2 years at state expense, even if their flying performance does not meet the required minimum standard. This "principle" also applies to state examinations which students have to pass in order to acquire their pilot's certificate. (195, 243).

4. Periodically-held Courses

Along with the regular educational institutions and schools, a number of different courses, seminars, meetings and training camps are organized at the schools as well as locally, under the direction of Territorial Administrations, airports and operational units. Among such, "Courses for Plane Commanders" have been mentioned. (109, 229).

At the present time, the need for more centralized instruction for Shipping Department workers, as well as for stewardesses is stressed. Another problem is the introduction into service of plane commanders newly graduated from the School of Advanced Pilotage. (219, 229).

There are also advocates for centralizing the operations of local training units by subordinating them directly to the Directorate of Educational Institutions of the Main Administration, rather than to the Territorial Administrations. (161).

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As an item of curiosity, a kennel for thorough-bred South-Russian sheep dogs (collies) can be mentioned. It is operating at one of the Khar'kov units of the Aeroflot. The establishment started in 1953. The dogs are used for watching airfields as well as other installations. Some of them have earned medals and diplomas. The kennel, in recognition of good results attained, participated in the All-Union Agricultural Exhibition in Moscow in 1955. (92).

G. INTERNATIONAL COOPERATION

1. General

The newly-adopted Soviet policy of penetrating the outer world through cooperation, also finds its expression in the field of air transportation. "The development of international air communications helps to extend cooperation, consolidate friendship among the nations, and strengthen economic and cultural relations with foreign countries", as phrased by the Deputy Chief of the Aeroflot in the early 1955. (10, 254).

The network of international communications has been extended well beyond the Soviet orbit of allies and satellites in recent years. As a result of this expansion, the rate of growth of Soviet international airline transport has increased four-fold between 1954 and early 1956. The number of passengers is increasing fastest on the Moscow-Irkutsk-Khabarovsk route, which has developed into an important international air artery, connecting Red China, North Korea and Mongolia with the USSR and other Communist countries, as well as with the outside world. (164).

The widening of international economic and cultural ties has also increased the number of foreigners on USSR air routes. Statesmen, public figures, numerous delegations, tourists visiting USSR, "serving as a means of political, cultural and economic cooperation between the nations", are crowding the USSR domestic routes. Flights carrying foreign travelers doubled 1955, in comparison with 1954. "Many important assignments of serving foreign parliamentary delegations, statesmen, as well as political and social notables and tourists from 58 countries have been successfully accomplished" (164, 229).

The new policy of closer contact with the outside world has apparently struck the right note in the feelings of the average man. Thus, the workers of the Shipping Department of the Rostov airport are reported to be learning English "to serve foreign tourists better". (177).

The trend toward "cooperation" is also reflected in Soviet participation in international air conferences. In September 1955, the USSR was represented at the Haque Conference for revision of the Warsaw Aviation Convention of 1929. The work of that conference was praised by the Soviets as an "important contribution toward the closer cooperation of nations in the field of civil aviation". (97, 105).

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The Soviet Union also sent observers to the sixty-six nation conference of members of the International Organization of Civil Aviation, held in Montreal from 30 August to 30 September, 1955. (106, 130).

In November 1955, the USSR participated in the proceedings of the Parachute Commission of the International Aviation Federation in Vienna, Austria, in cooperation with Great Britian, France, USA, Austria, Western Germany, Czechoslovakia, Bulgaria, Hungary, and others. (128).

In effect, the Soviets state with an air of satisfaction:

"According to agreements with various foreign airlines, passenger and freight traffic from Moscow reaches most of the countries of the world, including South America and Africa". (164).

Specifically, Soviet endeavors to spread their international influence have resulted in following agreements with other countries.

2. Within the Communist Orbit

Albania. Regular air service to USSR was restored on February 1, 1955, from Tirana via Belgrad, Budapest and Kiyev to Moscow. (321).

An agreement and a protocol on air communication was signed in Tirana on 6 December 1955. (128, 131, 144, 269).

Bulgaria. An agreement with the USSR was signed on 5 March 1955 in Moscow, establishing the Moscow-Sofia route flown by Soviet and Bulgarian aircraft transporting passengers, luggage, freight and mail. (24, 131, 255).

In July or August 1956, an additional agreement was signed concerning technical cooperation in the field of civil aviation. (280, 310).

China. By an agreement of 12 October 1954, the Soviet share in the joint Soviet-Chinese Aviation Company was transferred to China, effective January 1, 1955. The formal act of transfer was accomplished in Peking on 29 December 1954. (304).

In connection with the above, an agreement concerning regular air communication between the two countries was signed on 30 December 1954 in Peking. The Moscow-Peking, Alma-Ata-Urumchi and Chita-Peking air routes were established, all flown by Soviet and Chinese aircraft. (304).

An additional agreement concerning technical cooperation in the field of civil aviation was signed between the representatives of the GUGVF and the Chinese Civil Aviation Administration on January 4, 1956. (131, 144, 255).

Czechoslovakia. Regular air communication between Prague and Moscow with a stopover in Vilnyus was inaugurated on April 18, 1955, with the first flight being made by a Czechoslovak aircraft. (48, 131, 255, 329).

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East Germany. An agreement concerning technical cooperation in the field of civil aviation between East Germany and the USSR was signed on 18 October 1955 by representatives on the Deutsche Lufthansa and the GUGVF. Regular operation, based on an earlier agreement, was started on 7 October, 1956. (106, 131, 250, 305a).

Hungary. An agreement establishing direct air communication between Budapest and Moscow was signed on February 11, 1955, in Moscow. The route is to be operated by Soviet and Hungarian aircraft. (131, 255, 261).

Mongolia. An agreement between the governmental delegations concerning air transportation between the parties, was signed on December 1, 1956, in Moscow. Under this agreement, all property of the GUGVF on Mongolian territory passed into Mongolian ownership free of charge. (131, 287a).

North Korea. An agreement, under which the joint Soviet-Korean Air Transport Company (SOKAO), established in 1949, was to be transferred completely to North Korea, was signed around October 1955. The USSR was to be compensated for its relinquished share by delivery of North Korean goods over a number of years. (97).

Subsequently, an agreement on air transportation was signed by the USSR and North Korea on December 7, 1955 in Pyongyang. (128, 269).

Probably the same agreement also contained regulations concerning cooperation in technical maintenance of the Pyongyang-Moscow route. The Moscow-Chita stretch was to be flown by GUGVF aircraft, the remainder of the route--by North Korean planes. The flight frequency was scheduled as 4 flights weekly. (131, 144).

Poland. An agreement establishing regular air transportation between Warsaw and Moscow was signed on 18 February 1955 in Warsaw. (131, 255, 262).

Romania. An agreement establishing regular air transportation was signed with the USSR on or about January, 1955. (259).

An additional agreement concerning technical cooperation in the field of civil aviation was signed by the representatives of the GUGVF and the Romanian Main Administration of the Air Fleet of the Ministry of Water and Air Transportation, in Moscow in January, 1956. (131, 144).

Yugoslavia. An agreement about air communication was concluded in Moscow on September 3, 1955. The agreement provides for a direct air route between Belgrad and Moscow, to be operated by Soviet as well as Yugoslav aircraft. (97).

The agreement has been subsequently ratified, and the ratification instruments exchanged on 28 November 1955 in Belgrad. (128, 144).

Following the above, a conference between the representatives of the parties about transportation regulations and mutual servicing of the route, was held in Belgrad from 22 October to 1 November, 1955. The agreement was signed on November 1, 1955. Operations began on 29 November 1955. (106, 128, 131).

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Other activities toward closer cooperation with the satellite countries comprise technical aid in special applications of aviation, especially in agriculture.' Satellite aviators and specialists have been admitted for training by a number of Soviet operational units of Special Purpose Aviation. (128, 152).

Serial production of the Soviet Il-14 planes was being introduced in the Prague Aviation Works in Czechoslovakia in August-September 1956. This is the first heavy-type of plane to be produced by Czechoslovak industry. (237).

3. Outside the Communist Orbit

Afghanistan. An agreement establishing regular air communication between the USSR and Afghanistan was signed in Kabul on 24 March, 1956. The agreement was ratified by the Soviets on 2 July, 1956, and the ratification instruments were exchanged on 25 August 1956 in Moscow. (177, 278, 284).

Following the above, an agreement on commercial cooperation and reciprocal service was signed on 1 November 1956 in Moscow by the representative of the GUGVF and the "Da Ariana Khovayi Sherkat", Afghan Aviation Co. (131, 255, 287).

Austria. An agreement concerning air communications was signed between the parties on 9 November 1955 in Vienna. (106, 131, 255).

Belgium. An agreement concerning the joint maintenance and commercial cooperation between the parties in the field of civil aviation was signed by the representatives of the GUGVF and the Belgian Aviation Company SABENA some time before June, 1956. (190).

Finland. According to the agreement between the parties, a Moscow-Helsinki air route was opened about March, 1955. On this occasion the first Finnish AERO plane flew to Moscow. It was a non-stop schedule, with 6 flights weekly. (166).

On October 19, 1955, an agreement was signed in Moscow concerning direct air communication between the parties. It replaced the agreement formerly effective. (106, 305).

Following the above, an agreement between the representatives of the GUGVF and the Finnish Air Transport Company AERO was concluded in Helsinki concerning organization and joint operation of the Helsinki-Moscow route on 10 December 1955. The route goes non-stop from Moscow via Velikiye Luki and Narva to Helsinki. Six weekly flights were scheduled to be flown by Soviet and Finnish aircraft. Regular traffic was planned to start on 18 February, 1956. (131, 255, 271, 331).

France. Air communication is stated to exist between USSR and France. (131, 255).

Great Britain. An agreement concerning commercial cooperation between the representatives of the GUGVF and the British European Airways was signed on 19 November, 1955 in Moscow. (106).

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India. An agreement concerning passenger and cargo air transport was signed between the USS and India in Moscow some time before October 1955. (97).

Scandinavian Countries. Air Transportation Agreements were signed with Sweden, Denmark and Norway on March 31, 1956 in Moscow, permitting civilian planes to fly to and from the capitals of these countries. On the same day another agreement concerning commerical cooperation in the field of civil aviation was signed between the representatives of the GUGVF and the Scandianavian Airline SAS. According to these agreements, regular passenger flights were to be organized between the USSR and Sweden over the Moscow-Stockholm and Riga-Stockholm routes. The Denmark routes were established between Moscow and Copenhagen and Riga-Copenhagen. With Norway the service followed the Moscow-Riga-Stockholm-Oslo and Riga-Stockholm-Oslo routes. (177, 190, 272, 317).

Actual flights began on 8 and 9 May 1956, using Il-12 planes from the Soviet side and the SAS planes from the other parties. (131, 206, 255, 273).

Switzerland. An agreement concerning commercial cooperation between the parties in the field of civil aviation was signed by representatives of the GUGVF and the Swiss Air Transportation Company SUISSE AIR on 27 January, 1956, in Moscow. (154).

USA. An agreement concerning cooperation in the field of civil aviation was signed by the representatives of the GUGVF and the Pan American World Airways (PAA) on 24 August 1956 in Moscow. (283).

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PART II. OPERATION

GENERAL PATTERN OF AIR COMMUNICATIONS

The network of the Soviet air communications is conspicuously centered in the capital. Moscow with its two airports of Vnukovo and Bykovo in the service of civil aviation, dominates the whole network: about one hundred flights on Union-wide routes start and end here daily during the summer period. The main artery of air communications goes from Moscow in the easterly direction, connecting all the important cities on the Moscow-Khabarovsk route with a frequency of 17 to 9 runs daily by Il-12 planes. The furthest points served by that union-wide route are Vladivostok, Yuzhno-Sakhalinsk and Magadan. The next important general direction is Central Asia, which is served by 4-5 runs of Il-12s and about the same flight frequency of Li-2 planes. A relatively high traffic density is maintained in the Caucasus and Ukrainian direction, but predominantly with the lighter Li-2 planes. The westerly and northerly directions show the least densities of traffic. The western direction, however, is scheduled to more than triple its traffic volume during the present (1956-1960) Five-year Plan period. (246).

In the attached diagram (Inclosure 9), the 1956 summer flight schedules are charted to show the network and the traffic densities on all legs. (10). A detailed picture of traffic densities in different directions can be derived from Table 1.

A comparison of the 1956 summer communications pattern with that of the earlier schedules (winter of 1954/55*) reveals the following differences.

The main eastern artery shows a considerable increase of frequency, which is now maintained nearly uniformly up to Khabarovsk. Khabarovsk has developed into the second largest airport of the USSR, after Vnukovo, in terms of passenger turnover. This reflects the general intensity of growth of Siberian air traffic, which increased by 323 per cent in ton/kilometers, in the Far Eastern Territorial Administration and by 289 per cent in the East Siberian Administration, the total increase for the Northern, Siberian and the Far Eastern regions being 206 per cent

*The traffic densities in winter 1954/55 have been charted in the report "Aeroflot in Facts and Figures", AF677415.

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Table 1

Hours and distances flown per day by various types of aircraft in various directions from Moscow (Summer 1956)

Direction from Moscow	Plane type	Houbs flown per day h.m	Distance flown per day km	Percentages	
				Hours	Km
Eastern	Li-2	279.05	63,490	40	42
	Il-12	676.30	191,650		
Volga	Li-2	52.00	11,610	3	2
	Il-12	—	—		
Caucasus	Li-2	350.35	74,380	19	18
	Il-12	109.15	29,130		
Crimean	Li-2	107.25	23,430	5	5
	Il-12	8.30	2,460		
Ukrainian	Li-2	209.35	46,310	9	9
	Il-12	10.30	3,000		
Western & Northern	Li-2	186.20	42,315	9	8
	Il-12	18.15	4,780		
Totals	Li-2	1,376.20	304,605	57.3	51.3
by	Il-12	1,013.00	285,420	42.2	48.2
plane type	Il-14	9.45	2,910	.5	.5
Grand Total		2,399.05	592,935	100	100

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during the period 1950-1955. The increase in turnover from 1954 to 1955 in the remote parts of the North, Siberia and Far East was 30 per cent, the general increase being 8.3 per cent. By the spring of 1956, nearly half (24 out of 60 per cent) of the ton/kilometers carried on the main (i.e. scheduled) routes were moving on the Khabarovsk-Moscow stretch. (164).

All other directions also show marked increase in traffic density, particularly in the southerly and the Caucasus directions.

Of other changes, some of which may turn out to be of permanent character, the following deserve mention: the town of Noril'sk, near the estuary of the Yenisey River, which in the winter 1954/55 was served from Krasnoyarsk, has now been connected with Moscow more directly, via Vorkuta. The route from Moscow to Murmansk, near the Norwegian border, has been changed to lie via Arkhangel'sk, rather than via Leningrad.

Table 1 applies to the network of nation-wide air communications as shown in the published official schedules. Not all routes, however, are shown in the schedules; some, especially those serving the Northern part of Siberia are excluded. Not included in schedules, further, is the network of local communications, which remains a matter of separate treatment later in this report (Part II, C,3). The very large number of airports alone (more than 260) in addition to those serviced by regular scheduled flights, suggests a rather extensive local network.*

According to a Soviet statement, the traffic in ton/kilometers on the "main and resort routes"** makes 60 per cent of the total, the remaining 40 percent being shared by international and local lines, the majority of the latter (21 percent out of 40) falling to Siberian, Far Eastern and Central Asian regions. (164). Disregarding local air traffic for the time being, the materials available enable us to establish a number of statistical data concerning capability of Soviet civil aviation within the network of all-union significance.

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*It should be remembered that the Civil Aviation does not operate along the northern coast of Siberia, where a separate network of Arctic Aviation is operating under jurisdiction of the Northern Sea Route. (Analyst's note).

**Which usually mean the routes included in official schedules, often also referred to as the "routes of all-union significance."

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B. STATISTICAL DATA CONCERNING POTENTIAL

1. General

It is known that Soviet statistics are kept up to date on the following factors comprising the potential of the civil aviation organization.

(a) Airline network mileage

(b) Flying stock

(c) Utilization of equipment. (13)

However, except for some scattered and, for the most part, unreconciliable figures concerning network mileage, no absolute data is being published on these indices. Nevertheless, an analysis of flight schedules and of related data from other sources provides a basis for fairly close estimates.

For general orientation, the following official data showing the growth of potential during pre-war 5-year plan periods may be of interest: (19)

Volume of air transport	1928-1932	1933-1937	1937-1939
Passengers	67,520	553,075*	488,900
Freight (tons)	932.8	86,916.2	85,360.6
Mail (tons)	943.0	20,592.0	15,646.5

These data reveal a very high rate of growth since the beginning of the First Five-Year Plan in 1928.

For 1939, the following comparative data were given:

	Network mileage in km	Transported: Passengers	Mail tons	Freight tons	Percentage of pay load
USSR	116,100	248,000	5858.1	37,843.0	86
USA	103,016	1,267,580	4046.9		56 (19)

*For the single year 1936, the figure has been put at 158,000. (20)

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According to these comparative data, the USSR is shown, already in 1939, ahead of the United States in network mileage and volume of air mail. Although such a relationship can be seriously questioned, the figures applying to USSR are valuable for a more detailed determination of the rate of growth of the Soviet civil air potential as presented in the previous table.

2. Network Mileage

The term "network mileage" is used for the sum of single-direction straight-line lengths of all legs of the network, flown at any frequency. This interpretation agrees with the Soviet method as far as the sum of single-direction lengths of legs is concerned.(18). The exact length of individual legs, however, is not known. As the nearest possible approximation, the straight-line distance between the points concerned was taken for the length of leg. This causes a certain underestimation in the figures arrived at below. The amount of error, however, would hardly exceed a small percentage.

The above method was used in analyzing the 1956 summer schedules. The network mileage of domestic routes was found to be 115,630 kilometers. The types of aircraft flying various proportions of network mileage breaks down as follows:

Li-2 planes	81,250 km
Il-12 planes	48,095 km
Il-14 planes	2,910 km
	132,255 km,
of which the combined coverage by two or all three types, makes	16,625 km
Network mileage - - -	115,630 km (10)

This figure tallies very closely with the network mileage of 106,100 derived from the 1954-1955 winter schedules by the same method of analysis*. The increase of 9,530 km is readily explainable by the seasonal fluctuation of air traffic; partly it may also be due to growth of air transportation in general, which can be determined by a continued analysis of a longer series of summer and winter schedules.

It is of interest to compare the figures derived from schedules to data found in other sources. In the beginning of 1955, for instance, the deputy chief of the Aeroflot, N. A. Zhavoronkov,

*See AIIR No. AF 677415 of 25 July 1955, page 5.

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stated in the periodical Soviet Union** that the network of airways extends over a distance of more than 108,700 miles, which corresponds to about 174,000 kilometers. The excess of 58,370 km over the above figure of 115,600 km appears to apply to local as well as to Arctic routes excluded from the published schedules, since Zhavoronkov's figure most probably, covers the entire network. (254).

Another Soviet source (June 24, 1956) gives the total mileage of "domestic routes, all-union or local, flown by aircraft" as exceeding 200,000 kilometers, which would place the Soviet Union, according to this source, first among nations in respect to airline mileage. Since the international routes do not appear to be included in the figure, this seems to be an overstatement, both in respect to the figure, and in placing the USSR ahead of the other nations. (302).

A third source puts the total mileage of Soviet airways at 142,000 kilometers in 1945, a figure, however, which cannot be taken very seriously since it applies to the time immediately following the war. (16a).

A German source quoting Soviet data puts the total USSR domestic airline mileage at 261,513 km in 1952. This figure, obviously, must also include the Arctic Aviation (AVIAARKTIKA) routes, as well as the 1700-km Alma-Ata-Hami line. Since the mileage covered by Arctic Aviation is unknown, it is not possible to determine from this source the exact mileage covered by the Aeroflot alone. Furthermore, the same source, estimates the total Aeroflot and AVIAARKTIKA mileage at only 105,326 km, which is undoubtedly too low an estimate. (25).

In conclusion, it may be assumed with a fair degree of accuracy that the total domestic airline mileage of the USSR is not far from the 200,000 kilometer margin, about 60 per cent of which (115,630 km) are the publicly scheduled routes of all-union significance, the remaining 40 per cent (approximately 84,000 km) being divided between international and local or feeder routes.

This estimate also fits fairly well into the general pattern of past development; the total airline mileage since the end of the First Five-year Plan period being as follows:

In 1933	-	36,000 km	
1937		93,000 km	
1939		116,000 km	
1940		138,000 km***	
1945		142,000 km	(19,308)

The last figure, already referred to above, reflects the standstill in development over the war years.

**English-language edition.
***According to another source 106,000 km (16a).

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3. Mileage and Hours Flown

The mileage and hours flown on domestic scheduled routes were derived from the same 1956 summer schedules as was used for network mileage. The mileage flown was deducted from individual timetables as the sum of straight-line distances of the legs of a flight, doubled for roundtrip and multiplied by the flight frequency, i.e. the average number of roundtrips scheduled for a 24-hour period. The hours flown were likewise computed from individual schedules, subtracting from the scheduled round trip flight time the stopovers in intermediate airports, and multiplying the net flying time by the frequency. The results of the analysis are presented in Table 2. (10).

As seen from the table, the mileage flown on scheduled flights during the summer season of 1956, totals 591,845 kilometers or about 370,000 miles per day. The number of hours flown per day amounts to 2392 hours and 25 minutes.

The table also shows the relative share of plane types in the totals, along with that of individual Territorial Administrations, or rather, of the 14 main airports, in the operation of the Aeroflot.

Table 2

Mileages and Hours Flown in Scheduled Operations on Domestic Routes by Territorial Administrations (Summer 1956)

Territorial Administrations	Aircraft type	(Per aircraft type) km flown per day	hours flown per day	Totals km flown per day	hours flown per day
1. Moscow	Li-2	28,960	125.40	58,000	232.05
	Il-12	29,040	106.25		
2. West Siberian (Novosibirsk)	Li-2	12,020	53.20	30,580	119.50
	Il-12	18,560	66.30		
3. East Siberian (Irkutsk)	Li-2	8,730	39.25	8,730	39.25
4. Far Eastern (Khabarovsk)	Li-2	--	--	10,800	39.00
	Il-12	10,800	39.00		
5. Central Asia (Tashkent)	Li-2	38,810	168.25	64,460	257.50
	Il-12	22,740	79.40		
	Il-14	2,910	9.45		
6. Kazakh (Alma-Ata)	Li-2	9,240	40.45	40,200	147.50
	Il-12	30,960	107.05		
7. Volga (Kuybyshev)	Li-2	44,570	204.45	44,570	204.45
	Il-12				

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Table 2 (Continued)

Territorial Administrations	Aircraft type	(Per aircraft type) km flown per day	hours flown per day	Totals km flown per day	Totals hours flown per day
8. North Caucasian (Rostov)	Li-2	24,910	115.20	24,910	115.20
	Il-12	———	———		
9. Georgian (Tbilisi)	Li-2	5,180	26.30	12,440	54.45
	Il-12	7,260	28.15		
10. Armenian (Yerevan)	Li-2	5,010	25.10	5,010	25.10
	Il-12	———	———		
11. Azerbaydzhan (Baku)	Li-2	6,010	26.05	13,910	53.55
	Il-12	7,900	27.50		
12. Ukrainian (Kiyev)	Li-2	62,370	287.15	67,630	305.40
	Il-12	5,260	18.25		
13. Western (Minsk)	Li-2	15,225	69.45	15,255	69.45
	Il-12	———	———		
14. Northern (Leningrad)	Li-2	42,340	187.15	48,750	212.15
	Il-12	6,410	25.00		
Totals for Aircraft types	Li-2	303,375	1,369.40	445,215	1,877.35
	Il-12	138,930	498.10		
	Il-14	2,910	9.45		
Totals for 14 Administrations				445,215	1,877.35

Joint Operations of Territorial Administrations

Moscow East Siberian Far Eastern	Il-12	14,800 14,680	51.40 52.30	29,480	104.10
West Siberian East Siberian Far Eastern	Il-12	14,800	51.40	14,800	51.40

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Table 2 (Continued)

Territorial Administrations	Aircraft type	(Per aircraft type) km flown	hours flown per day	Totals km flown	hours flown per day
Moscow		13,480	47.35		
East Siberian	Il-12	13,480	46.40	26,960	94.15
Moscow West Siberian East Siberian	Il-12	13,480	47.40	13,480	47.40
Moscow East Siberian	Il-12	13,390	47.35	13,390	47.35
West Siberian East Siberian	Il-12	13,480	47.40	13,480	47.40
West Siberian Moscow Far Eastern	Il-12	14,680	52.30	14,680	52.30
Moscow	Il-12	3,130	10.10		
West Siberian		3,130	10.10	6,260	20.20
West Siberian Far Eastern	Il-12	14,100	49.00	14,100	49.00
Total of Joint operation		146,630	514.50	146,630	514.50

Table 2 (Summary)

	Aircraft type	(Per aircraft type) km flown	hours flown per day	Percentages
Totals by plane types	Li-2	303,375	1,369.40	57
	Il-12	285,560	1,013.00	42
	Il-14	2,910	9.45	1
Final Total		591,845	2,392.25	100

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4. Flying and Commercial Speed

The flying speed shown below is the average of the mileage flown per day divided by the average hours flown per day, both computed from individual flights. The commercial speed was computed in the same way, except that stopovers were included in the average flight time.

These computations yielded following figures:

Plane type	Flying speed (V_f) km/hr	Commercial speed (V_c) km/hr	$\frac{V_c}{V_f}$ per cent
Li-2	221 (222)	173 (182)	88 (82)
Il-12	282 (281)	206 (207)	73 (74)
Il-14	299 (297)	220 (246)	74 (83)

The figures derived by **analysis** of 1954-1955 winter schedules are shown in parentheses, for purposes of comparison.

5. Estimates of Flying Stock and Manpower

a. Flying stock.

Soviet open sources do not contain any direct data concerning the number of planes in operation. Estimates concerning flying stock, however, can be derived from the hours flown, as given above, provided that the rate of equipment utilization and the average percentages of aircraft undergoing maintenance and repair can be determined with a reasonable degree of accuracy. The term "Utilization rate" denotes the ratio of actual hours flown to the calendar time an aircraft has been carried on the list of equipment assigned to an operational unit. "Listed" equipment comprises all aircraft of an operational unit, including those actually out of operation due to damage, repair or some other reason. In some cases the utilization rate refers to the time a plane has been in actual operation, instead of being listed. The ratio of aircraft in actual operation to those on the list is used to determine the condition of the flying stock. In evaluation of figures denoting the utilization rate, attention must be paid to whether the "listed" or the "in operation" time is used. Operational units tend to use the "in operation" time, while the central organs are pressing upon the "listed" figures, thereby accounting also for the condition of flying stock in individual units.

Equipment utilization rate (e.u.r.) is sometimes expressed in Soviet sources as a percentage, sometimes as the number of hours flown per plane per year, but most often as the number of hours flown per plane per month.

Although the sources are very scant with respect to the equipment utilization rate, some pertinent indications are available. In

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one source, for instance, equipment utilization rates for Li-2 planes in an operational unit are given, for past years, in hours per year and percentages, as follows:

1951 - 926 hours or 10.55 per cent of the year

1952 - 961 hours or 11.06 per cent of the year

1953 - 1001 hours or 12.5 per cent of the year

1954 - 1164 hours or 13.25 per cent of the year

1955 - 1298 hours or 14.7 per cent of the year (246).

Thus, in 1955 the utilization rate corresponded to about 103 hours per month in that particular unit.

The source fails to indicate, however, to what extent the unit was typical of other units, or was below or above average. It is also not clear whether the figures apply to flying stock in actual operation, or to the whole stock "listed" i.e. also including aircraft undergoing repairs.

In the same year (1955) some crews in a unit of North Caucasian Territory Administration, flew as little as 80 hours per month "while others were over-burdened". (79).

About the same time, the figure of 300 flying hours per month per plane is given as a possible goal, provided that the relay crew system is employed on flights. At the end of 1955, a unit using the relay crew system achieved a monthly average of 250-270 hours per plane in actual operation. *(81, 113).

In the same year (1955), as a result of introducing the relay crew system and a new flight schedule, a number of units raised the utilization rate of Il-12 planes to 1450 to 1600 hours per year for every plane "listed", and 2000 to 2240 hours per plane in actual operation. The monthly figures are 121-133 hours per plane listed and 167-187 hours per plane in operation. These figures yield, among other things, the ratio of the number of planes in actual operation to those "on list". The percentage derived from the given figures is approximately 72%. In other words more than 1/4 of flying stock on list, was out of operation at a given time. (164).

During the summer of 1955, the top utilization rate in some units reached an averaee of 300 to 350 hours per month. But these are record achievements. (84, 164, 205).

On the whole, the above data suggest that the equipment utilization rate in the Aeroflot does not generally exceed 200 hours per plane per month, and seldom falls below 100 hours, per plane "listed".

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Soviet sources also concede that in respect to the equipment utilization rate they lag behind the airlines of the United States, Great Britain, Belgium, Holland, and the Scandinavian countries. (205).

The above data on hours flown per day for ach plane type in conjunction with the approximate equipment utilization rate figures, can be used to derive the basic total number of aircraft flown on the scheduled routes of Aeroflot. (Table 3.)

Table 3

Plane type	Hours flown per day / per month (from Table 2)		Number of planes maximum (at 100 h per mo. e.u.r.)	minimum (at 200 h. per mo. e.u.r.)
Li.2	1370	41,100	411	206
Il-12	1013	30,390	304	152
Il-14	10	300	3*	2*
Total	2392	71,890	718	360

The total number of Il-12 and Li-2 aircraft, presented in Table 3, compares reasonably well with the corresponding figures for the 1954-1955 winter period. While the 1956 total figures were based on net flying hours and equipment utilization rates as given in the source material, the 1954-1955 figures were obtained from total time of operation on scheduled routes and official formulas specifying time ratios for maintenance, repair, and associated activities.** The results, obtained by these two methods, are compared in Table 4. It should be emphasized here, that these figures represent not the estimated actual number of aircraft in the service of Aeroflot but rather the minimum number that would be required to maintain the

*The very low figures for the new Li-14 aircraft are by no means indicative of the total number of these planes in operation. The table accounts only for a single Moscow-Tashkent flight scheduled for 1956 Summer; many other planes are in training units and carrying out unscheduled flights on other routes. (Analyst's remark).

** AIIR No. AF 677415, page 8.

official schedules under the specific conditions of operation, maintenance, administration, etc., currently prevailing in the Soviet Union.

Table 4

		Hours flown per day	Estimated number of aircraft	
Li-2	1954-55 winter	1310	340	
	1956 summer	1370	206 to 411	356*
IL-12	1954-55 winter	565	109	
	1956 summer	1013	152 to 304	198*

The estimated flying stock for domestic routes can also be compared to data for 1953 published in a German source. According to that source, the number of planes operating on Aeroflot routes, domestic and international, was:

Il-12 -- 350

Li-2 -- 300. (25)

For comparison purposes, these figures must be reduced by about 10 percent to exclude aircraft on international routes** and raised somewhat to reflect the addition of new flying stock between 1953 and 1956.

b. Manpower.

Practically no figures are published concerning manpower in the Aeroflot. The number of ground-service, administrative and repair personnel, etc., is kept in strict secrecy. The only information available applies to crews of some plane types; the number of crew numbers, depending on the plane type, varies between 2 and 5 men without stewardesses. Only one allusion concerning the ratio of the number of crews to the number of aircraft has been found. One author, discussing the possibilities of raising the equipment utilization rate, argues that introduction of the relay crew method would permit more intensive utilization of aircraft if more crews

*These figures are adaptations of the 1954-1955 winter figures to summer 1956 by increasing them in proportion to the increase in hours flown. This makes the 1954-1955 data directly comparable with the 1956 figures.

**The mileage flown daily on international routes was about 68,000 kilometers, while the figure on domestic routes exceeded 590,000 km per day. (10).

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were available. He proposes that each aircraft have "no less than 2 crews." This of course implies that the actual ratio is less than 2 to 1. Such data, however, is not sufficient for drawing any further conclusions, especially in respectto the total manpower. (62,246).

A rough idea of the total manpower can be derived from the statement by Chugunov, Inspector of Physical Training of the Main Administration: "More than 26,000 aviation workers are participating in sports clubs of the Aeroflot". (215). Whatever the proportion of "sportsmen" to the total force of the Aeroflot might be, it is clear that they would constitute only a fraction of the total staff.

C. OPERATIONS

1. Technical Operation

General

Flights are carried out according to "Instructions for Conducting Flights," issued by the Main Administration of the GVF. Since these instructions are not available at the time of this writing, only some general observations can be made on this subject. (121)

The Deputy Chief of the Aeroflot, Zakharov, in an article in the professional periodical Civil Aviation (Grazhdanskaya Aviatsiya), stresses following points as needing improvement:

(1) Passenger flights should be assigned to only the very best pilots, having perfect command of piloting techniques under bad-weather conditions, day or night;

(2) Steady improvement of pilots' qualifications by organization of training and checking of piloting practices;

(3) Thorough improvement of the organization and actual functioning of flight control, meteorological services and guidance of flights under bad-weather conditions;

(4) Better cooperation between airports and Territorial Administrations in dispatching and receiving aircraft. (120)

Other writers have suggested that information about pilotage in foreign countries be issued systematically by the State Scientific Research Institute of GVF. (59)

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The most radical suggestion voiced so far, recommends the instruction of foreign languages to personnel of border and other large airports in order to meet the "sharp rise in the flow of foreign travelers". (229, 59).

Attention is also drawn to the detrimental practice of splitting up crews without urgent necessity. Such composite crews brought together from different planes, are affected most by even a slight deterioration in the weather. Cases of confusion leading to "violation of instructions, and crashes" under bad weather conditions are actually reported from some areas, especially from the Far East and Siberia, where pilots, as well as flight controllers, often lose control of the situation. There have been cases of flight controllers refusing to receive planes in order to evade taking responsibility. (59).

Political organs urge closer check on the work of the administrative as well as managerial personnel, since "many commanders have shied away from the preparation of aircraft for flight". (84)

The distribution of assignments is done by the staffs of operational units. The roster is kept by the secretary and the recorder-technician. The stewardesses are subordinated directly to the Chief of Staff who personally details them for duty. (62).

The "flight assignments" are printed documents to be handed out to the crews detailed for a flight. Data about the movement and location of the plane are recorded in a journal kept in the staff of the unit. The record serves as a basis for computing the volume of fuel and oil on board, as well as fulfillment of flying quotas by the crew members. (62).

Economic Aspects of Operation

"Safety, regularity, and economy" are not only the three most frequently quoted goals set for the personnel of the Aeroflot but are also the main problems in Soviet Civil Aviation. Of these three issues, economy is given primary importance. (28, 81, 93, 131).

As far back as 20 years ago, the third Five-year Plan provided for "full utilization of ground and flight equipment, and safe, round-the-clock, fast, and regular functioning of air transportation." Up to this time, these goals still remain in the forefront of all requirements. Undoubtedly, a certain progress has been made, but there are still a multitude of shortcomings, stemming by and large from ultra-bureaucratic operational methods, which prevent smooth operation of the overly complex organization. The complaint of a unit commander can be cited as an example: "Instead of concrete help, we are flooded with paper. Over 3,000 orders, instructions, etc.,

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have been received by the staff of the unit from the Territorial Administration during 1955. By 20 April, 1956, the letters had already raached the consecutive number 2697 .....". (21,181).

Safety. No statistics concerning flight accidents are made public in the Soviet Union. The only exception was a crash of a passenger plane near Voronezh, on August 6, '55, in which 5 crew members and 20 passengers were killed, among them 10 members of a Norwegian women's delegation. The plane was reported to have "caught fire and exploded." There are numerous indications that flight accidents still constitute a very serious problem. The deputy chief of the Main Administration of the GVF, N. Zakharov, in an article published in January, 1956, urges again that primary attention in the coming year should be paid to flight safety: "This is the basis of further advancement. It involves a broad segment of the personnel and many sections of the organization". (120, 267, 59, 112).

In 1955, at a conference of the Chiefs of Territorial Administrations, much criticism was heard about the causes of accidents, inadequate safety measures, but, more particularly, the inertia of the Aviation Engineering Service of the Main Administration was blamed. There have also been conferences of Airport Flight Controllers (December 1955) with the same problem on their agenda. This problem is no less acute in Special Purpose Aviation. (59, 130, 144, 168).

One of the main causes of accidents is undoubtedly the poor quality of maintenance and repair. Next to that, bad weather and the poor condition of airfields during fall, winter and early spring are among the important causes. Accidents often occur even during taxiing, mostly because of the bad condition of the taxiways, "cluttered airfields", and also carelessness and speeding on the part of pilots. Conditions sometimes prevailing at Soviet airfields are described as follows: "lights covered over with snow, unmarked taxiway crossings, cranes, step-ladders, ramps scattered around." (113,182).

There are two "weather minimums," for pilots with different levels of experience. One category of pilots is qualified for flying at the first minimum during daylight hours and at the second minimum at night. This measure prohibits pilots with little experience from flying under bad weather conditions. But the requirement is not always complied with; there are cases, where "unit commanders themselves, in their race for higher indices, induce the crews to violate regulations on weather minimums. (84, 116, 181).

The condition of airfields is another problem. This is particularly true in winter with snow or ice-covered airfields, and also in spring when "Many airports without concrete runways must be closed for 15-25 days", while waiting for the ground to dry and harden after the slush period. In some cases, planes have been dispatched to closed airfields. Passing and crossing at the same altitude have

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also occurred. Educational measures having failed to cope with irresponsibility and carelessness, disciplinary means have been proposed. (118, 223).

Irregularity of flights is a widespread phenomenon in the Aeroflot. It is caused partly by the overly-restrictive, vigorously imposed safety regulations. The situation is often aggravated by poor organization of the communications system and disconcerted work of ground services; jams at transfer airfields often occur when the weather is below the minimum. (84, 113, 181, 219).

Numerous complaints are heard about delays in departure from airports of origin, especially in the Far East and Eastern Siberia, as well as about frequent delays en route, mainly because of the shortage of reserve planes or the low proportion of flying stock fit to make a flight. The latter charge applies not only to the Eastern routes, but to other routes as well, including even Moscow airports. (218,229).

Another cause for irregularity is the frequent lack of payload. This is normally a seasonal phenomenon, occurring mainly during bad winter or early spring weather, but also on flights to summer resorts and on local routes, in general.

During the spring slush, there is a serious payload shortage on main routes, since up to 50 per cent of the freight comes via peripherial airports, which sometimes remain closed for several weeks at a time. The result is a sharp slump in freight turnover at major airports such as Novosibirsk, Khar'kov, Sverdlovsk, Moscow, etc. This situation, which is considered the most acute of current problems, can hardly be corrected by accusing some chiefs of unwarranted closing their airfields for traffic. (113,162,164, 218,223).

Another source of delays is the assignment of various types of services (passenger, mail, freight) to the same plane. Whenever a passenger flight is also scheduled to carry mail or freight, delays become inevitable since the mail, as a rule, is always late in arriving, requiring passengers to wait 3-4 hours before taking off. During 6 months of 1956, 416 out of 732 departures were delayed, with loss of 1,340 hours of flight time. When overnight stops by planes at Vnukovo are added to this loss, the total idling time amounts to 8,620 hours. If this idling time could be reduced by half, 1.2 million extra ton/kilometers and 6,000,000 rubles of income would result. In 1956 a better condition of the flying stock and a 12% improvement in flight regularity as compared with 1955, have made it possible to introduce special non-scheduled freight flights. These are carried out during the daytime, with stops at every intermediate airport to exchange cargo. It is hoped that this measure will cut idling time and increase productivity. The increase of flying stock alone is believed to faciliate

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better organization of flights and compliance with schedules. Specifically, the general tendency to postpone all activity to the end of an accounting period (monthly, quarterly) and start work only when the gap between the actual output and the quota becomes threatening, is a widespread shortcoming, to be eradicated in the nearest future. (113, 120, 157, 162, 210, 246).

Passenger service on Soviet airlines is far below Western standards. Although a speedy improvement in this field has been declared the "most important duty of aviation workers", the actual conditions are changing very slowly. The Trade-union organs, in particular, are held responsible for an improvement in this service. (28, 120).

First of all, the fares are considered still high, because of prevailing high costs. In fact, air travel appears to be essentially the privilege of higher state and political functionaires. (120)

Airport hotels and other facilities for accommodation of pilots and passengers are inadequate. Under bad weather conditions, especially in winter when many planes remain grounded in airports, this shortage is painfully felt. (113, 120).

Mutual notification of flight schedules among the Territorial Administrations leaves much to be desired. The changes in schedules often are not made known to other administrations. This is one of the cause of confusion at the ticket windows. (91).

Information concerning changes in plane departure and arrival is often inadequate or misleading. The same applies to information concerning the number of transit passengers. Many airports of departure often fail to correctly inform the intermediate points about seats available on planes. Passengers seldom know definitely whether or not there are enough seats for them on arriving plane. There is a need for a reliable communications system between ticket selling agencies so that passengers can quicly be furnished the necessary information. (229).

In almost all airports much time is taken for checking baggage in or out. The premises are for the most part inadequate in respect to space as well as location; the work is poorly organized. In Moscow Vnukovo, for instance, 5 electric platform trucks stand idle while luggage is carried by hand or moved along on hand carts. There is even a shortage of porters at many airports. (211,229).

Ticket-selling and making reservations at transfer points for long-distance travelers need thorough reorganization. Teletype and long-distance telephones are needed for that purpose. It is proposed that the Moscow City Agency of the Aeroflot take over the functions of the control agency for selling tickets and making reservations. The shipping department of the Main Administration should be freed from operational functions to work on the improvement of service techniques and traffic organization. (229).

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Passenger baggage is not checked by city agencies, but only by airports. In addition, in most places there is no adequate transportation between the city agency and the airport. Air passengers have to wait 2 to 3 hours for a bus, or pay excessive rates for taxis (this applies especially to Sverdlovsk, Chelyabinsk, Magnitogarsk, and even to Moscow on Sundays. (211,229).

Economy. Along with the drive for safety and regularity, an ever-increasing campaign for "economy" has been maintained during the last few years. The aim is to make the plant of Aeroflot economically self-supporting. (41,81,113).

Up to the present, civil aviation has been an enterprise largely subsidized by the state. The quotas for accumulating reserve funds are only partially attained by individual Territorial Administrations. In 1955, for instance, the planned quota of reserve funds from operation of the Aeroflot remained unfulfilled, although some administrations (Krasnoyarsk, Kazakh, Northern) exceeded their quotas. At the same time, the deficit of the Far Eastern, East Siberian and Moscow administrations amounted to 115,000,000 rubles. (103,164).

The reasons for waste are manifold. One of the important causes of losses seems to be the low percentage of payload. On some routes it does not exceed 55-60 per cent of capacity. Capacity payload is attained only during 3-4 months of the year. (162,205).

The lack of freight is charged mainly to the poor work of shipping departments of airports, and especially to their lack of interest in advertising their services properly to the public, or showing any iniative in attracting customers. Even flight schedules are not always made available to the public. (48,79,154,157,248).

There is, however, another, perhaps a more serious reason for the inefficiency at airport. Shipping departments have cultivated a peculiar attitude, stemming from the highly intricate and often backfiring mesh of "socialist competition" persistently maintained among administrations, airports, and individual workers. (40). The situation can be briefly described as follows.

One of the indices, by which the results of the competition are evaluated, is the payload percentage. This index is applied to Territorial Administrations, airports, units and plane commanders or crews.

Although the plane commanders strongly resist competing for traffic volume, contending that this indicator depends mainly on the payload, which is entirely beyond their control, they are still made to share the responsibility with the shipping departments of the airports. Since the over-all volume of payload is essentially also beyond the control of most of the other competing units, the

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success of an individual unit depends, primarily, on how much payload it can add to its own credit at the expense of rivals. Thus, the stockrooms of the shipping departments are full of cargo, but to get them shipped, the plane commanders stopping at an airpost must appear personally at the stockrooms and literally "scratch out" cargo for their planes against the passive resistance of the airport personnel. This is the case when the plane in question belongs to an airport of another Territorail Administration, while the cargo piled up in the stockroom is "reserved" for planes of the airports "own" administration. The result is a considerable slowdown in the general speed of freight transportation on one hand, and a chronic "shortage of payload" on the other. The customers, in view of little or no time gain in using air transportation, turn to rail or other transport. The number of passengers also dwindles, especially during the winter period, when only 1/10 of the summer number travel. All this is due to irregularity and loss of time in air travel. (60, 62, 79, 118, 162, 184, 221, 248).

Another item of waste is fuel. There are special indices to evaluate the ratio of fuel consumption to profitable performance, which are applied to crews, units, airports and administrations. Intricate systems of "cruising graph's" and other instructions are introduced to economize fuel in flight. At the same time, the "natural loss" of fuel on its way from the factory to the aircraft tank reaches 2.5 per cent during spring and summer seasons. From a cylindrical tank of 1000 m^3 capacity, 8 tons of gasoline "evaporate" per month. Owing to the scarcity of tanking facilities at peripheral airports, planes have to take enough fuel from the base to last until the next available tanking place to make the entire trip without refueling. This, of course, reduces the payload capacity, the increase of which only by 15-20 kg per plane would save about 2,000,000 rubles on the average per Territorial Administration. (40, 81, 188).

An exaggerated insistence on "regularity" of flights also often prevents saving of fuel. For instance, it is not possible to utilize a favorable wind in flight since planes are not allowed to land ahead of schedule, even at smaller airports or at periods when there is no traffic congestion. Thus the planes are kept circling above the airfield often for as long as 15-25 minutes and each additional minute in the air costs about 20 rubles. The costfor going on the second circle is 200 rubles. (130,162, 181).

Here again "socialist competion" causes a detrimental rivalry between those who are supposed to cooperate. There is a marked discrimination, for instance, even in the assignment of flight altitudes by controllers, who favor their "own crews, while allocating less preferable channels to "outsiders." (79).

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All this, however, has not led to a revision of the competition system. Its shortcomings are charged to a lack of organizational ability of local functionaries. Yet socialist competition is consistently propagated as one of the main remedies in fighting inefficiency. (60, 93, 146, 164).

Another field of paramount importance in the economy problem is the rate of equipment utilization and time spent in maintenance and repair. If the number of planes in operation could be increased by only 1 per cent of the list number, the traffic volume of Aeroflot would swell by 3 to 5 million ton/kilometers per year. A major step toward an improvement in equipment utilization was the introduction at the end of 1954 of the system of relaying crews for flights, replacing the old method where crews were permanently attached to specific aircraft.* By now, the new method appears to be rather widely introduced in passenger service, although in mail and freight transportation, as well as in special purpose aviation, the old system still prevails. The results of the innovation have turned out to be considerable. In some units of the North Caucasian Administration, for example, the hours flown per plane increased from 4 hours 24 minutes to 7 h 30 m during 1955, reaching 9 h 30 m during the first half of 1956. As a result, the flying stock in operation was reduced by 4 planes, which cut the operation costs. At the same time the efficiency (in terms of traffic volume in ton/kilometers) improved considerably. In another unit (of the Kazakh Territorial Administration) the utilization rate was raised 2.5 fold after the introduction of the relay crew system. Certain other units nearly doubled their utilization rate. (93,123,164,205,208,210,248,249,294). On the other hand, higher rates of utilization have put an additional stress on maintenance and repair services: planes are now due for some form of regulation maintenance once in every 5 days on the average, whereas formerly the period was 9 days. Thus the benefits of the relay crew system cannot be fully utilized until the LERM capacity has been increased proportionately. The immediate bottleneck here lies in the periolously inadequate supply of spare parts and materials at workshops, causing up to 40-50 per cent time loss in the LERM. The key to the solution of this problem lies with the Main Administration and the aviation industry. (169, 249).

Soon after the introduction of the relay crew system, a drive towards the reduction of crews started. The first crew member to be eliminated was the flight mechanic. This innovation has been limited so far to Li-2 planes. The "Interim Instructions for conducting Flights on Li-2 Planes without Flight Mechanics" was issued by the Main Administration of the GVF in 1956. The duties of the flight

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*The introduction of relay crew system has been discussed in individual AIIRs Nos. AF682128, AF-717694 and AF 717696.

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mechanic were delegated in essence to the second pilot, partly also to the radio operator. The experiment caused a great deal of controversy and difficulties concerning the reassignment of duties within a crew; but particularly a problem was created by a lack of preparedness on the part of the ground services for the new pattern of maintenance. Also, the socialist competition occasioned complaints to the effect that planes assigned to crews operating without flight mechanics were mostly those the least fit technically or those about to be sent for overhaul. In summer 1956, progress in introducing this system was reported "bogged down in innumerable reports, speeches and resolutions about its importance". Additional instructions were then issued by the Main Administration. (113, 137, 141, 154, 169, 174, 184, 208, 219, 235, 246).

By the same period, however, the Ukrainian and Northern Territorial Administrations had managed to introduce reduced crew system and a drive began for its general introduction. Meanwhile, experimental flights had been started with even smaller crews, eliminating the radio operator as well as the mechanic. The results of this experiment have not yet been publicly discussed. (208, 212, 248, 250).

2. Maintenance and Repair

The problem of keeping the flying stock in good operating shape, is one of the most-discussed subjects in professional publications. A comprehensive report, based on such materials was prepared early in 1956 (AF 717689). In the present paper, more general and later aspects of the problem are treated.

The efficiency of maintenance is indicated by the ratio of the number of calendar days an aircraft stands idle to the number of calendar days it is in operation over a period of time, and also by the percentage of the total number of aircraft not in proper flying order. The basic document for keeping records of the flying stock is the aircraft specifications or log book, issued by the manufacturer and accompanying the aircraft. It serves for recording all the subsequent service of the aircraft. The actual average yearly idling time in the Aeroflot was, (prior to August 1956) 90 days in maintenance and 30 days in repair which constitutes a 35 percent loss of flying time. The top-level Vnukovo LERM is praised for keeping the flying stock in operation up to 95 percent of the time during the first half of 1956. (14, 204, 208).

Another index is the quality of maintenance and repair work, but it is not measurable in terms of exact figures.

The Airline Maintenance Workshops (LERM), as well as the Aircraft Repair Bases (ARB) are often blamed for long idling periods as well as for poor quality work. "A good half of all the confusion

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and commotion in the workshops stems from an attitude of indifference and a lack of organization." Party and Trade-union organs have written piles of orders and instructions, and established numerous controls over the organization as well as quality of work. (28, 84, 85, 120, 164).

In particular, the Siberian plants, such as those in Khabarovsk and Novosibirsk, lag far behind the rest, their idling time being three times that of Moscow establishments in 1955. Six to seven months have been spent on repair on some Il-12 planes in the Khabarovsk LERM. (164).

On the other hand, the Novosibirsk LERM lacked at least up to the end of 1955, the most necessary production space. Maintenance work had to be done in the open, with exposure to Siberian snowstorms. (118).

The increased repair work load caused by the introduction of the relay crew system of conducting flights, which resulted in a higher equipment utilization rate, released a new drive to improve work organization of the LERM. (113).

During the winter periods, the volume of work per plane also increases considerably. Although the traffic volume diminishes, the manifold risks and difficulties peculiar to winter flying result in more accidents and emergency work loads. (84, 118).

The over-all performance of the LERM has been rated so low in recent years that no first or second prizes were awarded to any establishment in the course of socialist competition for the year 1955. (164).

The major evil, however, is beyond the control of local establishments. As already mentioned in connection with the economy problem, the main bottleneck consists in the chronic shortage of spare parts and materials; also the necessary repair equipment is furnished late or is not available at all. Very often spare parts must be manufactured locally, or are made available only through local efforts by contacting a multitude of factories and agencies directly. One of the most efficient repair establishments (Shakhov's) received its materials and spare parts, in 1955, from 40 different places. The Deputy Minister of the Aviation Industry Lukin has promised (April 1956) "to take measures to satisfy the requirements of the Aeroflot in spare parts". The aviation industry was ordered to "liquidate the lag" in delivery of parts and to avoid further delays in the future. (96, 118, 119, 178).

Much stress is put on the work of the Production Control Departments within the LERM. It is believed that a closer check and a detailed record of every operation will improve efficiency. Even such a top establishment as the Vnukovo LERM, often praised for its accomplishments, is blamed for the "muddle" in its production organization.

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The main goal is to eliminate periodical production slumps during the first 2/3 of an accounting period (monthly, quarterly) followed by a rush period in the last third. (76, 84, 85, 96, 119, 178, 187).

The production control is also expected to attain a more even distribution of work load between shifts and groups. (85).

The management of the LERM, in turn, maintains that many failures of engines or mechanisms causing accidents and crashes, stem from poor design. In this respect, a closer contact between the LERM and the factories of the Aviation Ministry is advocated in order to bring the experience of the LERM to the notice of designers. For instance, seven proposals for improving the design of the Il-12 were made by the LERM in 1955. The creation of an inter-agency technical council to solve this problem has been recommended. (70, 247).

Although some progress seems to have been made lately in reducing the time required for medium and heavy repairs, the technical management of the LERM faces, as before, the future task of "changing in many respects the existing systems of maintenance and repair", as put by the Deputy Chief of the Aeroflot Zakharov. (120, 239, 246).

Up to the present, the new flow line method of maintenance and repair is still in process of introduction. The flow line method resembles that of the assembly line and is based on a number of well equipped work stations for repetitive operations, the work being carried in a sequence from one station to another. Started about 2 years ago, the new system has probably been introduced in a number of LERM for handling Li-2 type planes. The Il-12 and Il-14 (the latter still in the initial stage of introduction) are overhauled by flow method at only a few establishments (Moscow, Rostov, Kiyev). The Moscow-Vnukovo LERM is known to use, at least since summer 1956, the flow method for engine assembly, and the "specialization method"* for 100-flight hour maintenance. This has resulted in about a 1/3 cut in personnel, better utilization of space, and has more than doubled productivity. (170,178,187, 206,208).

There are two establishments, identified only by the names of their chiefs, Shakov and Izmiryan (the first probably in Moscow, the second in Kiyev or Rostov/Don), where the introduction of the flow method seems to be more or less accomplished, at least for certain kinds of regulation maintenance. Shakhov's plant has recently been used as a model plant, where technicians from other LERM are sent for instruction. Shakhov's plant was the first to introduce the flow

*The "specialization method" is a developmental stage preliminary to the introduction of the flow line method. Its purpose is a more proper division of labor among different groups of workers.

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method of repair of Li-2 planes, which has increased the output by 15% since the beginning of 1955. In addition to conventional plane types, the repair of helicopters was introduced in Shakhov's establishment in 1956. (178, 185, 187, 206, 208, 228, 230, 236).

Some advanced methods of defect detection and checking of work are used in these establishments. Thus, the X-ray, magnetic and luminescent checking, argon-electric welding, and thermal treatment of parts with automatic control, etc., are being used in Shakhov's plant. Precision casting, however, and automatic recording of engine test results, are still in the planning stage. (127, 128, 187).

At Izmiryan's plant, certain modifications have been made in the design of the new Il-14 airliner and about 700 various devices, tools, and pieces of equipment necessary for carrying out repairs on the Il-14 have been developed. (206, 228, 245).

A considerable number of other improvements have been introduced at various LERM as a result of efforts on the part of their personnel. Following is a listing of some recent innovations.

(1) Stationary, heated enclosure for engine maintenance and repair Li-2, Il-12, Il-14 planes, including tools and equipment for work stands developed by Moscow-Bykovo LERM, and The State Scientific Research Institute. (245).

(2) Replacement of the nitro-enamel finish of airframes by two coatings of KhVE-4 and KhBE-16 perchlorovinyl enamels, which double the strength of the protection coating and are less inflammable. (230).

(3) Addition of the RDV washing compound in the proportion of about 1/50, to gasoline used for washing, which causes quick sedimentation of dirt and permits repeated use of the same gasoline. Replacement of gasoline with "Detorgen" (DS), which often substitutes for a new finish. (230).

Use of the Detorgen in washing machines: To a 1 percent solution of Detorgen in 100 lt water, 1.5 kg calcined sodium carbonate and 50% bichromate (potassium bichromate) are added and heated up to 80°C. The resulting compound takes 25 minutes to remove not only oil and dirt, but also paint and varnish from parts. (230).

The usual means of washing the airframe surfaces are still kerosene and soap solutions, and the cleaning is confined to removal of soot from the nacelles and the wing center section. In some places washing machines (the MM-ZIS-150 for example) are used. (201).

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(4) Introduction of color anodizing of aluminum parts to replace the less efficient and more expensive operation of painting. It is achieved by the addition of aniline dye of any color into the galvanizing tank. In the process the protective dye precipitates into oxide layer, forming a hard coating. (230).

(5) Improvement of the methods of X-ray defectoscopy by introduction of a movable installation, probably to replace the bulky 500 kg RUP-2 type of stationary installation. Also the medical types of X-ray apparatus such as the RU-760, RU-735, and RU-736 are proposed for use in aircraft repair establishments. (198). [See photo, Fig. 10]. Since 1955, a number of special tools and apparatus, including quartz lamps, have already been in use in some units. (95).

(6) Introduction of painting of parts in an electric field originated in the Gor'kiy Automobile Works. Electrically charged parts, moving on a conveyor, attract particles of paint, which form a perfectly uniform layer. A considerable saving of paint is attained. All painting operations of repair shops could be performed on a single conveyor belt. (230).

(7) A device for measurement of the thickness of the galvanized layer for the restoration of worn parts, has been built at an unidentified establishment (Chief: Tsyba). (177).

(8) A new method of engine warm-up on the Mi-4 helicopter has been proposed in the Far Eastern Territorial Administration. This reduces warm-up time by half. (236).

(9) Standardization of fully-equipped work stands for basic regulation maintenance has been in the development stage at the Moscow Bykovo LERM since August 1956. (208).

(10) Stands for pumping kerosene and oil through inner cavities of parts; and for performing the same operation on engines prior to testing and for washing engines prior to disassembling are also being designed. (95).

(11) Special machines for removing residue from parts by means of bone or nutshell crumbs. (95).

A considerable extension of the network of repair establishments as well as the expansion of individual plants is scheduled for the present Sixth Five-year Plan period (1956-1960). The gross output is to be increased 2.2-folds. At the same time, the maintenance of new equipment (Il-14, Tu-104) is to be introduced. This growth

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is held possible only on the basis of a higher technological level, introduction of scientific innovation and application of more modern methods of work. The solution is believed to lie in more centralized production at large plants with highly competent design bureaus rather than in an extensive network of poorly equipped workshops. "Certain important measures will increase the efficiency of the LERM by 38 per cent and the gross output by more than 50 per cent by the end of 1960." (142, 127, 187, 192).

Regulation Maintenance

There are at least five different kinds of regulation maintenance perfomed in the Aeroflot. They are shown, along with the corresponding time allowances, in Table 5; the data are available only for Il-12 planes. In addition to those listed in the table, 200-hour maintenance has been mentioned in one source, but without giving any details. (71,143,249).

Table 5

Time quotasfor technical maintenance of Il-12 aircraft (143,233).

Kind of Maintenance	Total time allowed for maintenance (airframe and power plant)		Time for the maintenance of special equipment
	hours	labor time units	hours
Replacement of power plant after 350 hours of work. (249).	331.5	40.0	78.0
100-hour maintenance	127.7	12.0	13.5
50-hour maintenance	61.67	6.0	9.67
Post-flight maintenance	14.7	1.4	1.33
Short stop-over maintenance	3.62	.3	0.0
Pre-flight maintenance	5.98	.6	.97

A special labor time unit for determining the quantity of work required for different maintenance jobs has been introduced recently. The labor time unit is the average time, in so-called "norm hours", needed for the post-flight regulation maintenance of an aircraft. The labor time units differ locally, in conformity to conditions prevailing at a given plant. The units can be applied to various types through a rigid system of conversion factors. The labor time

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unit system was introduced on September 1, 1955. (143).

A proposal to introduce a system of determining the maintenance work volume in reference to the flying hour, along the lines adopted in the Western countries, has been discussed. The idea has been found to be "correct and exciting", but its application under Soviet conditions is considered to be impossible. (18, 249).

3. Local and Special Purpose Aviation Operations

a. Local and Feeder Routes

In this work, the designation of local, or feeder routes is tentatively applied to all routes not included in the published official all-union air route schedules. Since some routes of local character are included in the above schedules, and others, while not included, seem to have more than local significance, the "local", or "feeder" designation may need a correction in the future, when the particular considerations governing the selection of air routes for publication in official all-union schedules will be known.

The available information on local or feeder routes is very fragmentary and applies only to scattered areas of the country at different times. Many of these routes seem to be in operation seasonally. Therefore, the over-all network of local lines cannot be determined. In this connection, reference is made to Appendix No.2 attached to this report, listing all airports or airfields not included in the network covered by flight schedules for long-distance routes of all-union significance. This list, despite its incompleteness, gives an approximate idea of the extent of local and feeder routes in the USSR. Elsewhere in this work the approximate ratio of the mileage of local network to that of all-union routes was estimated. (Part II, Sections A, and B2)

The growth of traffic on local routes is illustrated by the increase in passenger turnover, which rose 70% during the Fifth Five-year Plan period (1951-1955). The goal for 1956, the first year of the Sixth Five-year Plan period, is 800,000 passengers and over 30,000,000 ton/kilometers. The total number of hours flown (including agricultural and other special applications) is scheduled to be at least 500,000 in 1956. (152).

The areas where the local lines are considered most important, are the vast roadless parts of Siberia, and particularly the Far East. The policy of preference of these areas was ordered officially by the resolution of the XXth Party Congress. The traffic volume in roadless areas comprised 23.1 per cent of the entire volume of local traffic in 1954. In 1955, the proportion rose to 28%. Passenger turnover in the first quarter of 1955 was 12.6 per cent higher than during the same period of 1954. These figures illustrate the growth of air traffic in areas where other means of transportation are lacking. (47, 169).

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The next area greatly dependent on air transportation is Central Asia. The route mileage in the Tadzhik SSR, for instance, tripled in the period from 1940 to 1955, whereas the traffic volume increased about 10-fold (297). The present process of large-scale cultivation of virgin lands in Kazakhstan necessitates special projects for extending local routes to serve new isolated settlements. The fares were lowered in 1956 to make air transportation more accessible to more people in those parts. Thus, on July 20, 1955, some new mail routes started operating in Severo-Kazakhstanskaya, Kokchetavskaya, Aktyubinskaya, Kustanayskaya and Pavlodarskaya oblasts, using Po-2 planes; the route runs from Petropavlovsk over Sovkhoz Ukrainskiy-Sovkhoz Dzhambulskiy - Presnovka and back to Petropavlovsk. (164, 192, 295, 297).

For general orientation about the density of local networks, two figures are available: the mileage of local routes in the Tadzhik SSR and in the Kazakh SSR: the network mileage for the first is 6,500, and over 8,000 km for the second. These figures apply to the summer of 1956. (177, 302).

At present, new equipment is being introduced on local lines: the older plane types are being replaced by the new An-2, Yak-12P, Yak-12M, and helicopters, as well as the An-2 with pontoons for landing on water. At the same time, better ground facilities are being demanded. In particular, radio stations are urged for local routes to "insure regular flights". (152).

b. Agricultural and Allied Operations

Application of aviation in agriculture, forestry, fishing and a number of allied lines appears to be developing at a rather high rate. Extensive acreages of state and collective farms as well as vast areas of virgin forests require the services of aircraft to faciliate their cultivation. The over-all volume of chemical treatment from the air has increased 2.5-fold by 1955 in comparison to 1951. The growth is 8-to 10-fold when compared to 1940. The increase from 1954 to 1955 was 35 per cent. The flying stock of agricultural aviation increased by 17 per cent during the Fifth Five-year Plan. Absolute figures about the actual volume of these operations, however, are very seldom published. The sources abound in relative figures, applying to different areas at different periods of time, and also to different kinds of work. An analysis, even if attempted, would hardly lead to consistent results. (61, 120, 152, 179, 302).

There seem to be two main areas of application of agricultural aviation:

(1) The Ukraine, including the North Caucasian plain, and

(2) the Central Asian Republics, with their cotton plantations

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and the vast steppes of which 28 to 30 million hectars are scheduled to be brought under cultivation by the end of 1956. (28, 166).

Extensive application of aviation is also going on in various parts of the European North and Siberia.

A number of figures illustrate the volume of work in some Central Asian Republics. In the Uzbek SSR, for instance, 647,000 hectares of cotton were given special artificial fertilization from the air in 1955, which about doubled the yield; more than a million hectares were scheduled for the same treatment for 1956, while fertilizing after autumn ploughing was scheduled for 80,000 hectares. The directives of the XXth Party Congress provide for 370,000 hectares of new protective forestation in the sands of Central Asian Republics. (106, 175).

In Kazakhstan, the total volume of work was 1,750,500 hectares in 1955, which is twice the volume of 1950. This comprises 15 different kinds of operations. (235).

In the Tadzhik SSR, some 62,000 hectares of cotton were sprayed during the first three quarters of 1955. In the same year pest control operations were carried out on the area of 117,000 hectares, fertilization on 40,000 hectares. The pest control goal for 1956 was 200,000 hectares. In the Turkmen SSR, the volume of crop dusting increased 2.6-fold during the Fifth Five-year plan period. (299, 302).

In East Siberian Territorial Administration, at least 600,000 hectares of crops in Irkutsk and Chita oblasts', and Yakut and Buryat-Mongol autonomous SSRs, are scheduled for aviation pest control and fertilization. (177).

On the other hand, the application of aviation for fighting pests and diseases in the Belorussian SSR is reported to lag much behind other areas, where the basic work already is carried out by aircraft. As an immediate task for aviation in Belorussia, the clearance of 2,700,000 hectares of bushland, was mentioned in the summer of 1955. (175).

The importance of aviation in agriculture is demonstrated by the fact that as many as 18 of the more efficient operational units and over 500 pilots of special service aviation participated in the All-Union Agricultural Exhibition in Moscow, among them 3 units from the Ukraine. (61, 131, 152).

The ways and means of application of aviation are worked out between the Main Administration of the GVF and the authorities who are going to use it, such as the Ministry of Agriculture of the Institute for Polar Agriculture. (73, 104).

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There are numerous factors, however, which handicap the utilization of aviation in agriculture. In Krasnodar Kray, for instance, the bulk of the work was done for state farms (sovkhoz), while the collective farms (kolkhoz) used aviation only for fighting pests, since these operations are centralized and carried out at the expense of the state. (231).

There are serious failures not only with respect to the fulfillment of plans, but also in insuring safety of flights. New equipment (the An-2 aircraft) is utilized at a slow rate in North Caucasian, Trans-Caucasian and Krasnoyarsk Territorial Administrations. The commercial payload is low. Idling time in chemical treatment of fields is very high. Only on pest control and fertilizing operations for sugar beets in the Ukraine, 2000 aircraft days were lost during 1955; similar losses occured elsewhere. (152).

The utilization of aviation in the state farms, is carried out most probably on the basis of orders from above. In collective farms, it is arranged on the basis of contracts between aviation units and the kolkhoz management. The kolkhoz, as a self-supporting establishment, can be persuaded to employ aircraft only when this seems to some extent economically justifiable. The reluctance of the kolkhozes is understandable if the actual circumstances are taken into account. (134, 231).

Kolkhozes for the most part lack the necessary facilities and equipment for successful employment of aircraft. Such facilities in short supply include adequate airfields, fuel storage and transportation facilities, water supply, tanks for mixing chemical compounds, pumps, mills for grinding caked fertilizers, etc. These requirements become more decisive with the introduction of more modern and efficient aircraft, such as the An-2. (231).

In addition, all technical equipment is managed not by the kolkhozes but by the Machine-Tractor Stations (MTS), which occupy the key position in the operation of kolkhozes. Thus, tripartite contracts are necessary to get work planned and started. The relationships have been under discussion for years. In 1954, a monograph entitled "Efforts of Civil Aviation in Furthering Agricultural Production" was published but has brought no practical results so far. (231).

A resolution of the September 1956 plenum of the Central Committee of the Communist Party strengthens the role of the MTS in the operation of the kolkhozes. Because the MTS "strive to avoid assisting kolkhozes when these employ aircraft on their own" the solution is seen in prohibiting kolkhozes from dealing directly with the aviation units, and to transfer the whole task of aircraft operation to the MTS. This system has been already introduced in the

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Uzbek SSR and reportedly has demonstrated its advantages. (231).

In any case, the actual work is to be done by the collective farmers: it is up to them to improve and extend the airfields, to supply the chemicals, prepare solutions, fill the planes, etc. A special staff for servicing the aircraft must also be created. So far, there are no uniform output quotas in this field of activity, and the workers are remunerated according to varying pay-scales. Often the kolkhozes are informed too late about the location of the airfield for the coming season. The chemicals are unloaded in places from which they must again be transferred. (231).

From the viewpoint of aviation there are also many difficulties. Criticisms have been voiced about accidents and "violations of discipline." Poor organization of work, incorrect direction of flights and ignorance of local conditions are the assumed causes. Some crashes have occurred with the new Yak-12R and An-2, reportedly because pilots are not yet accustomed to the new equipment. (152).

Then there is the chronic shortage of spare parts, which has put some planes out of commission for months. Much time is also lost in waiting for preparation of solutions (the lack of mechanical means makes the filling of planes with solutions a rather time-consuming procedure). (169).

Difficult living conditions in rural areas are another source of troubles. The aircraft crews have no proper accommodations, not enough rest. (169).

c. Other Special Purpose Applications

Medical aid is one of the most publicized applications of aircraft. In 1955, medical first-aid aviation flew 130,000 missions, transported 140,000 doctors and patients and about 600 tons of medical cargo. Another source, of June, 1956 states, however, that only 88,000 missions were flown "during the last years." (120,179).

In every oblast' capital there is a medical aid station equipped with aircraft. The station is subordinated to the oblast' hospital. An account on the Chernovtsy medical aid station furnishes some data about the work of such stations: 5,000 missions were flown to remote areas, and 705 operations were performed during the last 10 years. Only 65 missions were flown in 1945, while in 1955 the figure rose to 471. In 1955, during the intensive farming season, 239 trips were flown to outlying rayons of the oblast'; 4,000 collective farm workers were given medical examinations, 35 operations and blood transfusions performed, 39 local hospitals inspected, and 662 persons were given to X-ray examinations. At present, the regular flying stock of the station is 2 planes, but occasionally up to 6 planes have been detached for medical aid service. (176,255).

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The Chernovtsy station also carries out scheduled missions, for instance, for periodical medical inspection of the rural population or special inspections prior to heavy work season on farms. Such scheduled services have been performed since 1951. (176).

In Kzyl-Ordinskaya oblast', medical aid aviation was introduced in 1946. Prior to 1951, 750 missions were flown to remote villages. (292).

In the Nenets National Region, helicopters have been used since 1955 for communication with the reindeer ranchers of that region. The service comprises medical aid as well as the transport of newsprint and other necessities." (106).

Aerial Photography is used primarily for cartographic and topographic work. In the Fifth five-year plan period the total area aerially photographed amounted to several million square kilometers. (179).

Geophysical Prospecting is often carried out with the help of aircraft. In this field, helicopters find their most valued use. In the summer of 1955, a Mi-4 helicopter was used by an expedition of the Scientific Research Institute of Geophysical Prospecting in the area of the middle Ob' River. (323, 325).

In 1956, a Combined Eastern Siberian Geophysical Expedition used planes for aeromagnetic survey of the Taiga near the Ilim River.(279).

Propaganda materials and propagandists are often carried by planes from place to place during electoral campaigns. (263).

Newsprint matrices of basic news items and editorials are regularly flown from Moscow to provincial cities for inclusions in local papers. In 1956, matrices were forwarded to 18 cities, under the supervision of the Senior Dispatcher of the Central Traffic Service, Artamonov. This service has been maintained since 1936. (189).

Clearing Ice-bound Rivers by dusting ice from planes, has been tried in Arkhangelisk in 1955/56. The dusting compound consists of black soot-like industrial wastes with the addition of salt. It effects an increased absorption of solar radiation and speeds up the melting of ice. (165).

Chasing wolves belongs to those rather odd applications of aviation, which time and again occur in Soviet practice. In some places this seems to be a more or less established occupation.

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d. Flight Equipment

The Special Purpose Aviation is at present in process of changing from the antiquated Po-2 planes to the new An-2, and Yak-12 type of aircraft, as well as to helicopters. The efficiency of the An-2 has been reported to be 4 to 6 times higher than that of the Po-2. The process of change-over, however, seems to be in its initial stage, although the new equipment has already been used in some places. Thus, during the summer of 1956, some units of the Northern Territorial Administration received the new equipment. In August, eight An-2 planes of the Moscow Special Purposes Aviation Group were hurried to Uzbekistan for the pre-harvest removal of leaves from the cotton plants. (170,236).

4. Training

a. General

Much attention is paid to the problem of keeping the qualifications of the flying crews and ground personnel on the required level and keeping up with technical advances. The work is going on (1) in special "Training units" of Territorial Administrations, and (2) in operational units along with the routine work. (30,66).

The number and location of the Training Units, as well as their detailed training programs are kept secret and were not available for this study. Criticism published concerning the actual conditions in the training units, however, is illuminating. The most detrimental condition seems to be the lack of centralized, concerted direction. "No one, in fact, is directing our activities", a critic writes after the reduction of the Department of Specialist Training of the Main Administration. (161).

Instruction is hindered primarily, by the shortage of textbooks and visual aids. Manuals and directions for handling new equipment appear with a delay of several years. The Il-14, Yak-12, the new helicopters are there, but no literature on their construction is available. This is especially acute in respect to engines. (161).

Then, the textbooks brought out by the Publishing and Editorial Department of the Main Administration are said to be of a low quality because they "avoid treating the more complicated problems of construction and operation." The number of copies printed is inadequate, so that only instructors and engineers are furnished with them. (161).

Another alarming problem is lack of a permanent staff of instructors; the best qualified specialists are not interested because it would mean a reduction in salary. Also, the qualifications of instructors lag badly behind the requirements. They are seldom given refresher

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courses, or sent to the aviation industry to inspect the newest technical developments. New equipment is often operated "blind" for a period of time. (161).

It is practically impossible to get a new aircraft just for the purpose of instruction and training. This may happen, if ever, after the equipment has been in operation at least 3 or 4 years. All instruction, therefore, is based on diagrams, which in turn are also very scarce. (161).

More information is available about the routine training activities in the operational units, which are carried on along with the daily work. (31).

The responsibility for the training activities in operational units rests primarily with the Unit Commander. He is held responsible for flight accidents and crashes whenever their cause is ascribed to mistakes by the pilot, co-pilot, or other crew members. (35).

The unit Commander is aided by the Pilot-instructor, the Senior Navigator, and Senior Engineer (30, 62, 115, 136, 148).

The training activities for raising the qualifications of workers are supposed to be carried out (1) in the process of actual work, and (2) at special lectures, seminars, simulated flights, preflight briefings and post-flight discussions held for various groups. (31, 35, 84).

It seems that more directives and requirements in regard to training are issued to various agencies, (administrative, political, trade-union) are operational units than the latter can possibly meet during the relatively limited spare time available for this purpose. An exception are the winter months when some exemplary units have managed to organize as many as 44 hours of instruction per month. (30,172).

These assignments start with the introduction into actual work of young pilots graduating from flying schools, they end with the "systematic instruction of commanders and instructors" themselves. A considerable resistance, or laxity, based on "self assuredness and overestimation of their powers" is the reaction of older pilots and plane commanders. A more practical reason, however, seems to be the lack of time for systematic training. The Main Administration of the GVF plans training programs for commanders, second pilots, flight mechanics, radio operators and instruction on operating various types of planes (30,43,59,66).

Centralized direction of the local training activities, which was formerly extended over all branches of instruction, has recently been abandoned in regard to specialist preparation. This field was formerly under the direction of the Department of Training

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Ground-service Specialists of the Main Administration of the GVF. With the abolition of the department, the training of specialists for ground services has largely been neglected. (16, 66).

Orders to "strengthen the propagation of knowledge in the field of aviation engineering" were issued by the Main Administration of the GVF at the beginning of 1956. This brought about a series of lectures in various areas (32 lectures were given in the Western Territorial Administration during the first quarter of 1956), but apparently without a positive general effect. Training programs for technical specialists are drawn up locally and vary considerably. The "exchange of experience" is slow and inadequate. (59,127,177).

The political management maintains that "all facilities for training personnel have been provided in units" - actually meaning that programs, orders and instructions have been issued. But the actual conditions in units are far from favorable for effective training work, in view of the shortage of visual aids, working models of equipment, training facilities and even furniture in some cases. The situation is of course much worse in operational units than in training units. Textbooks are hardly available, for instance, on aircraft such as the Yak-12 and An-2, meteorology and radio communications. They are lacking altogether on piloting techniques, aerodynamics and the economics of air transportation. The blame for all these deficiencies is placed particularly upon the Publishing and Editorial Department of the Main Administration, and the State Scientific Research Institute, who have failed to standardize and produce the necessary equipment, visual aids and literature, as well as to work out more up to date programs. (30, 66,172,196,225).

b. Introduction of Young Pilots into Service

The course consists of theoretical studies and practical flight training. The theoretical part is required to be closely tied to the actual operation of the unit, to the climatic conditions, the peculiarities of the terrain and the special kind of flights actually performed. (43).

The pre-flight inspection of the airframe and engine, detection of defects, starting and testing the engine, computation of the volume of fuel and lubricants, and other practical operations are the main requirements. (43).

The course follows a detailed schedule, specifying all subjects, exercises and flights in advance for the whole period. The experience has shown that a 3-month period of introductory training is sufficient. The program should be followed in due sequence, without cutting the exercises or the time for their accomplishment. (43).

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The near-minimum weather conditions for training flights should be chosen in accordance with the qualifications of the pilot. Every flight is preceded by a briefing, to make the student familiar with the next problem. (43).

In order to acquaint young pilots with the airfield, a tour along its periphery and the adjacent territory is made to investigate the approaches and obstacles and determine the sites for emergency landings. Every pilot must know in detail the local "Instructions for Flights Within the Area of the Airfield." (43).

c. Training on New Equipment

A special training problem is created by the introduction of new aircraft. Usually, study and training on new equipment starts after it is delivered to the unit. The start of actual operations with the new craft is often delayed. (66, 98).

This seems to have happened with the new Il-14 plane, as well as with the Yak-12 and the An-2 for local and special purpose units.

With the new jet airliner, the Tu-104, however, things have changed. A special training unit has been organized and a separate operational unit for jet aircraft was created in Moscow to start the process of introduction more systematically.

In any case, the introduction of a new plane type is a long and troublesome process under the conditions prevailing in the Soviet state.

d. Training in the Special Purpose Aviation

There is a special training unit of Special Purpose Aviation in Moscow. Very little, however, is known about its work. In other larger centers of Special Purpose Aviation, such as Kiyev, Minsk, Rostov-on-Don, Novosibirsk and Tashkent, periodic assemblies of engineers and technicians are organized. Such assemblies take place usually in the early spring, as in 1956. On these occasions the specialists of the Main Administration and the State Scientific Research Institute deliver lectures on organization, economy, special equipment and new kinds of work. In small places the lectures are carried out by specialists from Academies of Science, or Scientific and Educational Institutions of the local republics. (166).

At present, efforts are made to introduce the new An-2 and Yak-12 aircraft, along with modified special equipment, and new helicopters into Special Purpose Aviation. (84).

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PART III. EQUIPMENT AND TECHNIQUES

A. GENERAL

The Soviet Civil Aviation is undergoing a general process of modernization. The flight equipment as well as airfields, ground facilities and navigation and communications systems, are being replaced by new and more up-to-date models. The process is still in its beginning stage, but considerable efforts are being made to keep pace with Western developments.

B. FLIGHT EQUIPMENT

1. Airliners

Il-12. At present the Il-12 is one of the two standard types in actual operation. It is used primarily on long-distance routes from Moscow to the Far East, and for express runs on other long routes. (See Chart, Inclosure No. 9).

Li-2 is the other standard type, at present in operation on shorter routes in all directions. (See Chart, Inclosure No. 9).

These two aircraft types together carry practically the entire volume of scheduled passenger, mail, and freight transportation of the Aeroflot, with the exception of a single flight on the Moscow-Tashkent route scheduled for the new Il-14 in the summer of 1956. Both types have been modernized during recent years, especially in respect to navigation aids and other instruments; the passenger cabins have been reequipped. (10, 55, 127, 229, 298).

Individual planes of each type differ considerably in weight (up to 430 kg difference) due to changes in design from one series to another. There is a distinction between a "lighter" and heavier" aircraft of the same type, the former being preferred for longer flights. Their equipment varies: with each transfer, the new crew must investigate a number of units (carburetor, propeller, firefighting equipment, etc.) to study their special features. (210, 219).

Although the Il-12 and Li-2 constitute the bulk of the flight equipment, they are considered outdated. The Aeroflot is, at present, on the eve of a complete re-equipment with more modern piston-engine and jet airliners. (146, 192).

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Il-18. This was a civilian adaptation of a military transport. In 1952, as many as 265 such planes were reported to be operating the Aeroflot. During recent years the Il-18 has not been mentioned in any connection within the civil aviation. (25).

Il-20. This is probably the earliest jet plane employed on the Soviet air routes, although the Tu-70 has been also reported flying on Far Eastern routes as early as 1953. The Il-20 has been used for mail and freight transportation on easterly routes, reportedly between Moscow and Novosibirsk. Since 1954, its main task has been, however, the transport of matrices of such central newspapers as Pravda, Izvestiya, and Krasnaya Zvezda. The Il-20 was used for medical experiments to establish the norms of flying time for jet plane crews. The findings were that the flying time on a jet plane should not exceed 4-5 hours out of 24-hour period; a pre-flight rest of at least 16 hours, and a rest period of 48 hours between consecutive flights were found necessary. Monthly flying hours should not exceed 45 to 50 hours for each crew. (25, 55, 129, 158, 192, 204, 225, 255, 256, 320).

Il-14. (Fig.1) This is a new improved passenger and freight piston-engine airliner scheduled to replace the Il-12 and Li-2 in the immediate future. Its cruising speed is 320 km/h, and payload capacity is 2.5 tons. It is well equipped with radio communication apparatus, and is considered fully "safe". It has ASh-82T engines designed by Shvetsov, and is capable of taking off and conducting horizontal flight on a single engine. It's fuel consumption is lower than that of the Il-12. At the same time, its climb rate with full load on one engine is higher than that of the Il-12 on two engines. Its take-off run, furthermore, is considerably shorter. The aircraft has fast landing gear retraction and propeller feathering promoting safety, especially at the take-off and landing. However, it is more sensitive to irregularities of load distribution. A deadweight in the rear cargo compartment is necessary when the passenger cabin is empty. The same applies to side trimming. When flying on one engine, a 250-kg difference in fuel weight between the right and left tank groups will cause a bank toward the heavier wing. (55, 192, 206, 228).

"Instruction for flying the Il-14 aircraft" advise that the take-off be made at top engine speed. This is questioned, however, in regard to engine reliability and life span. (228).

The Il-14 has been in the process of introduction since 1954, but the 1956 summer schedules provide for only one run on alternate days between Moscow and Tashkent by that aircraft. In August the Moscow-Frunze route was flown for the first time, at an altitude of 3500-4000 m. It was announced that regular service on that route would begin "very soon". (10, 55, 316, 324).

Tu-104. This is the new Soviet passenger jet airliner, which became generally known by its flight to London in the beginning of 1956. Its cruising speed exceeded 800 km/h, at the flight altitude of 10,000 m. The Tu-104 carries 50 passengers. Its maximum speed is 1000 km/h, flight altitude, 10 - 11,000 m. A climb to 10,000 m altitude takes 20 to 25 minutes. (156, 179, 239, 276).

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The chronology of the process of its introduction, following the flight to London, can be summarized as follows:

May, 1956 -- Shown at an aviation exhibition in Zurich, Switzerland. (206).

June 15, 1956 -- Flight from Moscow-Vnukovo to Prague. Regular flights between Moscow and Vil'nyus announced. (236, 276).

July, 1956 -- Several additional Tu-104 aircraft were delivered to the Aeroflot. About the same time the first contingent of crews for the airliner left the special Jet Airliner Training Unit. A new contingent started training. (193).

Summer, 1956 -- Flights to Warsaw, Budapest, Copenhagen. (236).

August 10, 1956 -- Flight to Peking, with 22 passengers on board. The flight altitude of 10,000 m was occasionally increased to 11,000 m "due to local conditions". (236, 281, 290).

August 16, 1956 -- Another flight to Prague. The purpose of this flight was to bring a delegation of the Main Administration of the GVF to Czechoslovakia for talks about opening a regular jet airliner service between Moscow and Prague. (236, 282).

August, 1956 -- The opening of regular air service between Moscow and the Far East is announced for the "very near future". A series of test flights to that end were reported to be nearly completed. (211).

September 15, 1956 -- Regular flights opened from Moscow via Omsk to Irkutsk, and to Tbilisi, Tashkent. (239, 242, 288).

September 22, 1956 -- Regular passenger service between Moscow and Tbilisi over the main Caucasus range opened. The flight altitude-10,500 m. Thirty-six passengers, among them members of the Bulgarian Cultural Delegation, were on board. (288, 285).

October 12, 1956 -- Regular flights opened from Moscow to Prague. Preparations under way for opening of the Prague-Moscow-Peking and other routes. (239).

In the period from May 1955 to September 1956, several Tu-104 aircraft were undergoing flight tests. In October, 1956, delivery of a series of Tu-104 for 70 passengers was announced for very near future. (239).

No interruptions in flight schedules occurred during the first month of regular operation, except for "one unauthorized change of schedule by Chief of East Siberian Territorial Administration Filanovskiy". (239).

It is recognized, however, that "it would be naive to assume, that mass introduction of high speed aircraft could be accomplished without difficulties". The first flights revealed a lack of coordination between the "air" and the "ground", the latter lacking the facilities [illegible] organization to maintain regular jet airliner traffic. (120, 211).

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Regular flights of the Tu-104, therefore, were not continued during the winter of 1956, because of inadequate experience in flying jet airliners under difficult weather conditions and at night. The task has been designated as "not simple". The weather minima for the Tu-104 are still relatively very high, especially for take-off and landing. A better meteorological service, better facilities for instrument landing, improving the skill of crews through persistent training -- these are deemed the necessary prerequisites for a successful introduction of the new equipment. (120, 211, 239).

The ground facilities for winter service of the Tu-104 are generally inadequate. Before the onset of the snow season, the airports need electricity in parking areas, snow clearing equipment, local transportation equipment in working order, and additional space to share maintenance equipment for the Tu-104. In the Irkutsk airport, additional facilities to aid in receiving and landing the Tu-104 under low ceiling conditions are needed. Access roads to the parking places as well as taxiways from runways to the terminal have not been completed on time. In Omsk, the construction work had progressed further, but here also some deadlines were not met. (120, 239).

The problem of maintenance and repair of equipment, as radically different from the conventional as the Tu-104 aircraft, entails considerable difficulties. At the present time, there is a lack of both facilities and skills. Mechanized loading equipment is needed for the new aircraft. The Directorates of Aviation Engineering Service and Technical Supply and Procurement are held responsible for a timely solution of these problems. In particular, the following items of airfield equipment are needed: trucks, power plants, low-pressure compressors for testing airtightness of cabins, special refueling carts; a set of testing instruments for checking special equipment. (211, 239).

A further problem is the handling of an increased flow of passengers which accompanies the introduction of large and fast jet airliners. An especially difficult problem is food service in the air, in view of the difficulties in procuring high-quality foodstuffs. (239).

It is claimed that the solution to these problems should be based on intensive training and effective utilization of the currently accumulating experience with the new jet aircraft. Descriptive literature, summer and winter operating manuals, and visual aids are urgently needed for the training and instruction puposes. (239).

To provide for the exchange of experience on jet aircraft operation, a conference of technicians was planned to be held in the beginning of 1956. (129).

In the training of crews special attention should be paid to proper landing approach methods without unnecessary maneuvering. The economy of time is considered most important with the jet aircraft.(239)

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A special unit has been created in Moscow, probably at the Vnukovo airport to train on and operate the Tu-104 aircraft. The training program places much stress on the theory and application of radar equipment. Extensive theoretical knowledge is deemed necessary in view of the more complicated equipment, as well as high speed and correspondingly shorter time to accomplish the work, and to insure quick trouble shooting in flight. (170, 242).

In addition to the Tu-104, heavy turbo-prop transport aircraft has been created by the design bureau of O.K. Antonov. The transport was demonstrated on the 1956 Aviation Day at the Tushino airfield in Moscow. No further information on this plane was available at the time of preparing this report. (192).

The Tupolev design bureau is also working on a 4-engine jet super-airliner to carry 170 passengers. (179).

With the introduction of the jet airliners and turbo-prop transports, Soviet civil aviation was said to have entered the modern era of development. This occasion gave rise to renewed demands for better personnel performance, better flight safety, more discipline and to renewed attacks on the current laxity and inefficiency. (146).

According to the decision of the XXth Party Congress, the 6th Five-year Plan provides for "introduction of high-speed aircraft on the air routes and reconstruction of main basic airports", as well as air-ways. (131, 147).

A more distant perspective of aviation development is seen mainly in the application of atomic power for air transportation. Atomic power plants would "change basically the conceptions concerning the possi-bilities of aircraft". (306).

2. Local and Special Purpose Aircraft

The outdated PO-2 plane is still in use in many parts, but the Local and Special Purpose Aviation is generally well under way in the introduction of more recent types. The change-over is expected to be essentially complete during the present 6th Five-year Plan period. (208).

The new aircraft now being introduced comprises the following types.

An-2. Serial production of this aircraft was scheduled to begin in 1956. The type has the following functional variants: (140).

The agricultural An-2 has been used locally for 3-4 years. It is provided with an improved duster and sprayer, with pneumatically con-trolled flow valves. The controls are accessible to both crew members. Signal lights provide information on the work of the crop testing directing equipment. The inside walls of the chemical tank have an anti-corrosion coating of the VIAM-B3 varnish. The installation has a spraying rate of 21 kg of superphosphate per second. The aircraft is filled with dusting materials by manual method. (55, 179, 200, 322).

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The passenger An-2. The aircraft in its original form failed to meet all the requirements of passenger transportation, since it was designed as a compromise between the agricultural and the passenger transport functions. Since 1955, however, it was recognized that a plane once used for spraying poisons and fertilizers, was not fit for passenger transportation. Besides, the plane had no heating, ventilation and sound proofing. (55, 86).

By the initiative of a group of repair technicians, a special adaptation of the An-2 for passenger use was developed in 1956, which was approved subsequently by the original designer Antonov. The new aircraft accomodates 10 passengers and is now considered the basic carrier on local routes. (192, 247).

The An-2 on pontoons is used on water airports, especially in the North. It serves expeditions, fisheries, and also transportation. The An-2 with pontoons can be used the year round. It has water rudder and reversible propeller, can be easily maneuvered even in rough water, and can reach the pier under any circumstances. The small draft permits floating in shallows of .8 to 1.2 m in depth. In absence of proper runways for land-based aircraft, the An-2 is especially valuable wherever there are rivers or lakes. The demand for this aircraft in the North, however, largely exceeds the supply. (55, 139, 287b).

The An-2 is also adapted for skis instead of wheels or pontoons. This facilitates its use in Northern regions. The manufacturer of skis originally guaranteed the life of skis for 300 landings. As the actual life turned out not to exceed 150 to 180 landings, a redesign was undertaken in 1956 under the direction of Antonov, which is expected to allow for an extended guaranteed life. (221).

The supply of skis, on the whole, appears to be inadequate. For instance, in the Western Territorial Administration, the An-2 planes were idling all winter because of lack of skis. (181).

A special version of the An-2 for Far Eastern local lines has been proposed by local specialists from Nikolayevsk/Amur, in or before September 1956. The Ministry of Aviation Industry has accepted the proposal, and assigned the designer O. K. Antonov to work out and build a light 6-seat two-engine passenger plane. The high landing and take-off properties of this new aircraft would make possible its wide utilization in the inaccessible parts of the Far East. (235).

A similar proposal for a new plane type for local lines came from certain pilots of the Aleksandvorsk/Sakhalin airport. The new aircraft was intended smaller than the An-2, but with range considerable greater than that of the Yak-12R and Yak-12M. The project has been repeatedly discussed in factories, but no final decision reached up to the present. (167).

Yak-12R, introduced during or before 1954, is a light all-purpose plane, designed by A.S.Yakovlev, and provided with a 9-cylinder air cooled AI-14R engine, a roomy, heated cabin for 3 passengers, radio, and alcohol-fed mechanical windshield washers. Its aerodynamical properties are markedly better than those of the Po-2. (69, 192, 102, 167).

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The aircraft can be put on skis for winter use. The skis are furnished with fairings which prevent their submersion in deep snow, and brakes to improve maneuvrability. In 1956, a new type of metal skis was introduced, with an increased working surface, and with a braking system which insures good maneuvrability on hard as well as in loose snow. (102, 167).

A training version of the Yak-12R was created in 1955. It has dual control system including two throttle levers, and a new braking system replacing the tail skid brake. The additions have increased the weight of the plane by 13 kg. The aircraft has proved suitable for training purposes. (87).

Yak-12M is an improved version of the Yak-12R type for agricultural as well as passenger use. It has been introduced in 1955 and comes in 4 specialized models: passenger (3 persons), ambulance, freight, and agricultural. The aircraft has very good aerodynamic characteristics. It is provided with AI-14R 9-cylinder air-cooled engine, V-530-D11 variable pitch propeller, fixed landing gear, compressed air starter, wing flaps and fixed slats, pneumatic brakes, heated cabin, and modern radio equipment. Its flight weight exceeds that of the Yak-12R by 145 kg. To increase the range, the radio compass receiver may be removed. (55, 102, 150, 192).

The Yak-12M ambulance model carries two patients and an attendant. (150).

The Yak-12M freight model has a net for 300 kg of cargo. The front passenger seat may be removed to increase the load capacity. (150)

The Yak-12M agricultual model Has a 470 lt tank and a spraying and dusting installation. To increase useful load capacity, the radio transmitter and receiver, radio compass receiver and the front passenger seat are removed. The endurance of the aircraft is 2 hours rated speed. (150).

In 1956, the manufacturer considered plans to increase the load capacity of the Yak-12M passenger and agricultural models up to 400-600 kg. (167)

The Yak-12 M passenger model can be converted to ambulance use or freight transportation by 2 men in 25-30 minutes. The conversion for agricultural use takes 2 1/2 to 3 hours. (150).

The take-off run of the Yak-12M is considerably less than with the Po-2. (150).

The Yak-12M can use the ski equipment of the Yak-12R type. (102).

Yak-24, the "flying box-car", is a heavy freight helicopter with load capacity of 4 tons. No information concerning its actual introduction has been published yet. (192).

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Mi-4 helicopter, designed by M. L. Mil', is now being introduced in agriculture, aerial photography, and medical service in mountainous or otherwise unaccessible areas. The helicopter can carry 2 tons of freight, or 8 to 10 passengers. It has proved useful in aerial photography, forestry work, in the fishing industry, and passenger transportation, "especially for vacationists going to Crimea or Caucasus resorts". (55, 179, 192).

A cargo lift record was set by P. Kaprelyan on the Mi-4 in June 1956 over Moscow Tushino airfield. The altitude of 6, 017.5 m was attained with a 2 ton cargo; 1-ton cargo was lifted to the 6,048 m altitude by V. Vinitskiy. (309).

The two pilots set also a speed record of 187.254 km/h on a 500 km closed route. The International Aviation Federation approved these records. (206).

The first shipment of Mi-4 helicopters was delivered to Tashkent in or before May 1956. A big shipment of light and heavy helicopters was delivered to the units of the Northern Territorial Aviation in or before August 1956. During the current 6th Five-year Plan period Aeroflot will be equipped with "a large number of helicopters". (157, 190, 236).

K-10 helicopter is a very light craft produced under the direction of N.I. Kamov. This single-seater helicopter can hover or be maneuvered up and down in all directions. Its horizontal speed is 120 km/h. It can be landed easily on a deck of a ship or the bed of a truck, or on water. It has rubber pontoons inflated with air and can be operated as a motorboat. Its maximum altitude is 2,5000 m. It can descend to the ground by autorotation. The K-10 consumes 10-12 kg of fuel per 100 km. (106, 335).

There are indications of the existence of another light or portable helicopter by Mil', but no positive confirmation of the fact has been found. In any case, this is the first indication of putting light helicopters into actual service. (192, 236).

C. PILOTING EQUIPMENT AND TECHNIQUES

1. Aeronavigation

Aeronavigational equipment and techniques in the Aeroflot are determined to a high degree by the climatic conditions of the country, specifically, the long fall and winter period during which the most adverse flight conditions prevail. These conditions are most severe in the roadless East and North, where other means of transportation are practically non-existent and regular air service therefore acquires paramount importance.

Since Northern latitudes are involved, the short winter days place most of the flights in the night period without the sight of ground or visual orientation marks. Thus visual flight is out of consideration as the basic method of navigation. A comparison of flight schedules

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for 1954 - 1955 and 1956 - 1957 winter periods shows a reduction of overnight stopovers, especially on the main traffic artery between Moscow and the Far East. This indicates that night flying has been increasing constantly, and at present a considerable proportion of flights is carried on regardless of visual contact. This is why so much attention is paid to radio navigation techniques and equipment. (10, 34, 59).

However, even the use of radio is subject to disturbances under winter conditions. Ice and especially snowfall produce electrostatic charges (as a result of friction of snow against the airframe surface), which interfere with the indications of the radio-compass. The errors may reach up to 20° or even 40° right or left. Very considerable are errors in direction finding due to the "night effect". (34, 36).

Radio compasses (direction finders) which work on medium wavelengths and use a frequency band of about 1000 kc, are also subject to temporary loss of accuracy due to reflection and diffraction of radio waves from and around the objects in the vicinity of the transmitter. (36).

It is being repeatedly stressed that pilots use all the available navigational means simultaneously. There is a tendency still to rely on visual contact alone, disregarding even dead reckoning methods. The practice of using a single type of radio aid not correlated with any other navigational method is strongly discouraged. The deputy chief of the Aeroflot Zakharov, in June, 1955 urged anew the importance of the "utilization of landing system, course and glide path beacons, the instrument landing system, radio beacon radar installations". (55).

The methods of navigational control are classified as follows: by direction, by distance, and full control with a position fix. (34).

Directional control is based on airway radio installations, broadcasting stations, radio direction finders, homing beacons, visual contact, and dead reckoning. Distance control is based on radio installations located off the airway, pre-computed bearings, and dead reckoning. Full control is based on taking position fixes by radio-navigational means. (34).

In addition to these methods of orientation, there must be a "reliable" radio communication system between the pilot and the ground at all times. In winter, direct radio contact is required continuously during the entire flight. (34).

An article, describing the operation of a radi-compass, states that "This device has been widely adopted for aircraft navigation and landing. Navigation based on homing radio stations in conjunction with the use of the radio compass has almost completely replaced the zonal beacon system and now is successfully used in aviation along with the latest ultra-short wave systems. The radio compass became standard equipment on nearly every aircraft." The article does not, however, state if this situation is characteristic of the Soviet Union. (34).

Modern radio-navigational aids have been reported on the new models of aircraft recently placed in the service of Aeroflot. (131).

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On the other hand, only a limited number of airports are equipped with instrument landing facilities. During the period 1950 to 1955 the number of airports equipped for round-the-clock service is said to have been doubled, but at the same time only "the most important airports are equipped for flights at night and under bad weather conditions". The increase in the number of airports for round-the-clock service still is a goal often recurring in plans. (36, 131, 168, 179).

The Eastern air artery, the country's basic air thoroughfare, is said to be equipped with surveillance radar and additional homing beacons. Which of the airports of that route are so equipped is not known. In any case, only 3 airports on that route -- Omsk, Irkutsk, and Khabarovsk -- are prepared to receive the new Tu-104 jet airliners. (36, 98).

The quality of operation of radio-navigational aids is open to criticism. Flight testing of new instrument landing systems is poorly organized even at first-class airports, such as Moskva-Vnukovo and Leningrad. No operational training of flight crews in the use of such systems has been performed to any appreciable extent. Traffic controllers have no full assurance, when giving landing clearance, that the entire equipment is in good working order. (59).

Much criticism has been made public about the indifference of crews in respect to the proper utilization of available radio navigation aids. The direction finding is not always used for position determining. The units' commanders are said to be lenient in demanding the proper utilization of all available means. The "formal" attitude of crews toward the preparation for flights finds its expression in cases, where the radio centers slated for direction finding on the forthcoming flight, turn out to be scheduled silent at the time they are approached. Many defects in the utilization of technical means are ascribed to superficiality of inspection when changing crews. (148, 182).

A rough idea about the density of air traffic control centers can be derived from the following. To avoid the errors caused by the reception of reflected waves, it is recommended to use radio beacons only within the limits of direct-wave reception, which is between 60 and 180 kilometers. This requirement, however, is said to necessitate a more dense system of stations. This means that the average distance between stations at the time (January, 1955) was much over 180 km. (36).

A number of airports appear to be equipped with approach and landing systems, with course and glide path beacons, some of them also with radar stations. It is not known, however, how individual airports are equipped, except in individual cases. Besides Moscow airports, Vnukovo and Bykovo, the Rostov airport has a landing system, which is said to work automatically, without personnel; its operation is directed from the control tower. It may be assumed that at least "first-class" airports, i.e. the seats of Territorial Administrations, have some kind of instrument ground facilities for final approach and landing. (55).

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The majority of air traffic control centers has no equipment for tape recording of air-ground communications. The receivers and transmitters are, for the most part, tuned manually. A number of radio operators are being maintained at the centers for the sole purpose of tuning-in and recording of communications. A more direct contact between the controllers and the air is urged, by introduction of automatic recording and tuning, and equipping the controllers with headphones and laryngophones. (130).

There are no standard control boards for flight controllers. Those in use are manufactured locally by the repair workshops. (117).

Complaints have been voiced on the deficiencies in certain important parts of equipment. Thus the new VS-5 rectifiers issued by the Aircraft Repair Bases are short-lived and do not guarantee uninterrupted working. In the STK-2 transmitter, the power transformers as well as amplifiers and audio oscillators fail in a few weeks, in some cases in a couple of hours. An unidentified establishment, probably in L'vov, received an oscillograph "after years of waiting". The device, however, was delivered without the necessary accessories and the frequency modulator and electronic switchboard had to be made locally. (117).

There is a general shortage of technical literature, in particular of handbooks on the equipment in use. Even such literature actually published, by some reason does not reach local users. The Editorial and Publishing Department of the Main Administration is blamed for this deficiency. (117).

Soviet technicians hold that their system of flight control is more effective than that of foreign countries. The Soviet system is characterized as more "active", i.e. the ground controllers have more authority to direct the pilots. Flight control in other countries is considered "limited" since the ground equipment belongs to the state, whereas the carriers are private organizations. The Soviet authorities also maintain, that "no country outside the USSR employs an active flight control along the route with the aid of radar." But it is conceded that the use of radar within the Control zones is still far from being fully developed. In early 1956, a discussion was started on the proper dividion of functions between the Airport Control Towers, Airport Control Zone, and the Air Route Traffic Control Centers as well as the organization of each. (130).

A special instrument landing equipment is being used on some aircraft. But its application appears to be limited to certain routes and the aircraft concerned. The effectiveness of the device seems to be questionable, since its use in fog, for example, is not allowed by the flight instructions. This may be partly ascribed also to the low accuracy of some other instruments. The basic altimeters' readings, for instance, differ up to 50 m; often a 30 m altitude reading is retained for some time after landing. On the Il-12, the variometer shows descent until 40-50 m altitude has been attained, while the altimeter pointer stays below zero. (32, 33).

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The accuracy of ± 1 m at altitudes up to 150 m is required for safe instrument landing, but the present technical specifications allow errors up to ± 30 m. There are also local peculiarities where, for instance, at the Vnukovo airport the instrument reading is 120 m against the actual altitude of only 60 m when coming in on the 242° course. (32).

Another example given is that of gyro-horizon which does not show the roll within 2-3°; the glide path angle must be controlled by eye. The delay in the readings of the radio compass is another handicap; during the time necessary for readjustment of its readings the plane covers a considerable distance. Furthermore, the speed indicator may fail under icing conditions. If the dynamic intake gets clogged, the instrument is turned into a static pressure gauge with speed readings changing with the altitude; if the static intake fails, both the speed and altitude meters fail. In the latter case the altitudes must be taken from the barograph. (32).

The installation of more accurate altimeters, which has been under way at least since 1955, is progressing slowly. The old type of altimeter was inaccurate incurring collision hazard at intersections of air routes. The new type is said to allow for "simpler and more reliable rules" for crossings. (139).

Cathode-ray tubes with increased brightness are required for the radar equipment of the control centers. The State Scientific Research Institute was charged with solving the problem of transmitting aircraft radar indications from the intermediate airports to the control centers. (130).

On the whole, the low degree of accuracy of the above navigational aids is behind the questionable reliability of the instrument landing practice in the Aeroflot. Although the necessity of a more economical utilization of the instrument landing system, different radio navigational and radar installations by automatization and reduction of personnel has been urged by top level officials (Deputy Chief of the Aeroflot Zakharov, in 1955) for some time, the materialization of the advices has been delayed. In fact, the automatization of the instrument landing system, for instance, is often left to local enthusiasts. Different circuits and designs for automatization and remote control of the instrument landing system have been worked out by several technicians (N. Zhirnov, V. M. Petrovskiy, Z. L. Keller) at the Rostov airport. These devices make it possible to switch on and off the approach and marker beacons, obstruction lights, code light signal towers, as well as change over automatically to reserve beacons. The Rostov airport appears to be one of the few to have such facilities. The example of Rostov, for instance, has been only partly followed by Khar'kov airport, resulting in some cut in the personnel. The Ukrainians did not copy the Rostov equipment, but have introduced their own ideas. There are similar attempts under way in Karaganda and Ulan-Ude airports, but apparently without a centralized guidance. (55, 60, 138, 173, 218).

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2. Control Tower Operations

With growing traffic density, airports must improve their traffic handling techniques: A better organization of flights within the airport control zone, and reducing the intervals between landings, especially under bad weather conditions, become necessary to meet the increasing requirements. (33).

The landing procedure, as governed by the control tower, consists of two phases. The first phase consists of flying a stack pattern and extends from the time of passing the outer homing beacon to the time of commencing the landing approach. During this phase, the aircraft descends through a succession of assigned altitudes and comes out on the downwind leg at the time specified by the controller. The second phase consists of the standard instrument landing procedure. This, at the Soviet Civil Air Fleet airports, is based on a rectangular landing pattern, with the first turn made directly after passing the outer homing beacon. The Il-12 aircraft takes 6 min. 45 sec. to fly the second phase, with the distance between the outer and inner homing beacons being 3000 m, and that between the inner homing beacon and the runway being 1000m. The total time, beginning with passing the outer homing beacon, is 9 min. 6 sec.

The controller, by assigning the time of commencing the landing approach to each aircraft, regulates the rate of landings at the airport.

In assigning the time of commencing the landing approach for individual aircraft, the flight controller assumes that the time interval for performing the landing operation from the starting point to the touch down is practically the same (6 min 45 sec) with all conventional types of aircraft (Li-2, Il-12, Il-14); therefore, it is sufficient for the controller to determine just the intervals between arrivals of successive aircraft at the starting point, disregarding the intervals for actual landings. The pilots are required to account for wind during the entire landing maneuver, thereby insuring the timely arrival at the start, a requirement which is not always followed to conclude from the discussions of its techniques. (33).

D. COMMUNICATIONS EQUIPMENT

Data concerning communications equipment on different types of aircraft as well as on the ground, are rarely published. The scattered indications available permit only observations of a very limited scope.

Ultra short wave radio equipment has been in the process of introduction since 1955. To what extent the new apparatus is actually installed, at the present time, is not known. In the second half of 1955, the ground communications equipment was lagging in relation to airborne equipment. (84).

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In 1956, a radio teletype device was reported to have been developed, capable of receiving and typing about 400 symbols per minute. The new system was scheduled to be introduced in meteorological service. (206).

Some efforts are being made to introduce high-speed (two-way vibrational and electronic) transmitting keys for telegraphic communications. By 1956, however, very vew of such keys were in actual use. (149, 170).

The introduction of bell call apparatus in flight control centers was started in 1956. The device is said to be interference-proof, allowing for a change-over from telegraphic to direct radio-telephone communications among flight controllers, with use of an automatic call system. One operator can handle two or more channels. (173).

Generally, communications among the elements of ground services is still largely radio-telegraphic, radio-telephone being in the early stage of introduction. The ground-to-air radio telephone communication is also deficient in certain respects. Crews in flight are not always well informed about changing weather condiditions along the route and in terminal airports. High-power radio-telephone transmitters at flight control centers should replace the present inadequate radio-telegraphic system. (173).

To improve ground-to-air communications, specialists propose ultra-short wave equipment. Ultra-short waves are considered especially desirable for use with jet airliners becaue of the high flight altitude involved. (173).

A further increase in the range of the ultra-short wave system is seen in the creation of a network of relay transmitters along the air routes. Another avenue of future development consists in the utilization of scatter propagation, depending upon higher radiated energy levels and highly sensitive receivers. The increase in the effective radiated power is deemed feasible, not only through the use of more powerful transmitters, but also by more efficient high-gain antennas. (173).

Finally, in view of the introduction of jet aircraft, the role of ground radar installations for tracking aircraft in the air and during landing, is acquires more importance. The crews in flight could be furnished with more accurate data about the air traffic situation. (173).

E. AIRFIELD CONDITION AND EQUIPMENT

Soviet airfields, with the exception of a small proportion of so-called first class airports, are, by Western standards, in a relatively poor shape. This applies to their physical condition as well as to the equipment. Information on individual airports, as far as available, is contained in the attached lists of airports. (Appendix 1 and 2).

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1. Condition

Many airports lack concrete runways and are therefore inoperative for 2 to 4 weeks during the spring or fall slush period. The effect of this is felt even in main airports such as Moscow, Sverdlovsk, Novosibirsk or Khar'kov, where the freight turnover drops sharply during that period. As an example, the Tomsk airport was closed for 15 days in April 1956. (30, 223)

In many airports, loose dust and sand constitute a menace to aircraft engines during summer period. The wear of engines on unprotected airfields is excessively high. Attempts to remedy this condition consist, on one hand, in installing dust filters on engines, and, on the other, in binding the flying sand and dust by a layer of loam, mixed with the sand with the addition of a solution of low grade asphalt and heavy oil. After rolling, such runways are said to be hard enough to support trucks. The improvement of airfields is the duty of local personnel. (80).

New terminal buildings have been erected in a number of first class airports during the post war years (see Appendix 1). But in most lesser airports buildings are of a very primitive kind. (131). The number of "airports equipped for round-the-clock service," does not seem to exceed that of the first-class airports (the seats of territorial administrations). Even first-class airports are closed for night operation. Thus Tbilisi, one of the major airports, was closed from 9:45 P.M. to 4 A.M. in 1955. (131, 334).

2. Equipment

The equipment of most airports is inadequate. In some places even such hand tools as wrenches for tightening nuts or replacing spark plugs, are lacking. Delays in the preparation of aircraft for flight are often caused by shortage of simple instruments. In many airports, including even Moscow-Vnukovo, there are not enough containers for disposal of sediment from fuel tank strainers or canisters for alcohol. (111, 184).

Mechanical loaders are not generally available. In September 1955, a ZAN-2 loading truck was approved for production in one of the aircraft repair establishments. (192).

One of the most time and labor consuming jobs is the warming-up of engines during the winter period. The existing heaters, as the APL and the IP-40 do not meet the requirements, the first being too slow, the latter unreliable. For years the airports have been expecting electric heaters, but they had not been delivered at least by by the end of 1955. (111).

A partial solution of this problem is being prepared in some airports by the supply of natural gas. In Kiyev airport, for instance, a new installation was scheduled for testing in fall of 1956. The system was designed and produced by a group of Kiyev airport specialists in cooperation with the State Scientific Research Institute. (218).

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The equipment and expansion of airports for operation of the new jet aircraft, such as the Tu-104, is a task of immediate future. At present, only a few airports on the Far Eastern artery as well as Central Asia and Caucasus terminal airports (Tashkent, Tbilisi) have been provisionally prepared for operating jet aircraft. (169).

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LIST OF AIRPORTS I

The following is a list of airports participating in the all-union network of USSR civil air routes based on the official summer schedules of 1956. Whenever possible, additional information on individual airports, as located in the available open sources, has been included.

1. Adler

   A new airport terminal was under construction in 1954, comprising a hotel, restaurant, large waiting hall, post and telegraph, to be completed by the end of 1954. An additional terminal building was planned (February 1955) to be completed by the end of '55. Terminal was still under construction January 1956; revision of the project was urged. Another report estimated completion for 1956. (126, 192, 260, 327).

2. Akmolinsk

3. Aktyubinsk

   A hotel was planned in February 1955. (260).

4. Alma-Ata

   The airport is located 18 km north of the city. Terminal building reported nearing completion October 1955. An additional terminal building was planned in February 1955, to be completed by the end of the year. A new terminal was opened in January 1956. It consists of several halls, with radiant heating, a spacious lobby and is reported to be one of the largest in the country. The tower is 25 m high. The side facing the airfield has a semi-circular colonnade and two porticoes. A two-story hotel and other buildings were planned to be erected next to the terminal. According to other sources, the hotel and a restaurant occupy the second floor of the terminal building. (17, 97, 254, 260, 332).

5. Aral'sk

6. Arkhangel'sk

7. Arzamas

8. Ashkhabad

9. Astrakhan'

10. Atbasar

11. Baku

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The airport was to be supplied with gas for heating, warming up of engines, etc. Baku airport city agency is located on Leninskiy Prospekt, No. 16. (124, 258).

12. Balkhash

13. Barnaul

14. Batumi

15. Chardzhou

16. Chelyabinsk

Additional terminal building was planned in February 1955, to be completed by the end of the year. Terminal building to be opened in May 1956, (260, 332).

17. Cherepovets

18. Chernovtsy

19. Chimkent

20. Chita

New airport terminal was under construction in May '54. Other sources report the new airport (terminal) built by or before February '55. New terminal building with hotel reported in Sept. '56. (254, 229, 326).

21. Chkalov

22. Dnepropetrovsk

23. Dzhusaly

24. Frunze

Additional terminal building was planned in February 1955, to be completed by the end of the year. Terminal reported to be completed by 1956. (192, 260).

25. Gor'kiy

26. Groznyy

27. Gur'yev

28. Irkutsk

A number of operational flying units are subordinated to Irkutsk airport.

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A new building for a training center has for years been in the planning stage. In January 1956, the blueprints for the structure were still arriving piece by piece. (54, 126).

29. Izhevsk

30. Kakhovka

31. Kaliningrad

32. Karaganda

Air terminal was reported under construction in Sept '55. The terminal includes a waiting hall and an operations room. The latter contains information bureau, ticket office, a check room, post office, telegraph. The right wing of the structure contains a restaurant, the left, a mother and child room, and doctor's office. Central heating, hot water, and ventilation are provided. A concrete taxiway leads right to the terminal. The terminal was still under construction in January 1956; revision of the project was urged. (92, 126).

33. Kazan'

New terminal was reported opened May '54. It was built in or before February 1955. The construction of the new airport and hotel was reported again in September 1956. (229, 254, 326).

34. Kemerovo

35. Khabarovsk

Chief of LERM: Komarovich. New airport terminal was reported opened May '54. It was built in or before February 1955. A new terminal with hotel was reported in 1956. (229, 254, 326).

36. Khar'kov

New terminal was being built in May '54. (326). It was also reported under construction in or before February '55. (254). The adjacent territory of the airport and the approach roads were improved. (229).

Khar'kov airport comprises a number of operational units. (92).

37. Kherson

38. Kirensk

39. Kirov

40. Kishinev

A terminal to be completed by 1956. (192).

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41. Kiyev

A terminal to be completed by 1956. The airport is to be supplied with gas for heating, warming-up engines, etc.

42. Kokchetav

43. Krasnodar

Chief: Borodavkin. (56).

44. Krasnovodsk

45. Krasnoyarsk

The new terminal is not far from the gray tower of an ancient fort. The airfield has wide reinforced concrete runways and asphalted road. It maintained service to Arctic region. A new terminal was under construction in May 1954, and was reported completed in September 1956. (229, 254, 253, 326).

46. Kurgan

47. Kursk

48. Kustanay

A new terminal was reported nearing completion in October 1955. (97). The terminal was still under construction in January 1956; revision of the project was urged. (126).

49. Kutaisi

50. Kuybyshev

A new terminal was to be completed by 1956. (192). The airport was to be supplied with gas for heating, warming-up engines etc. (124).

A LERM of the airport (108) comprising a Repair Brigade under Baydakov, was reported in October 1956. (240).

51. Kzyl-Orda

52. Leninabad

The airport has summer pavilions, hotels and restaurants (297).

53. Leningrad

A new airport terminal was built in or before February 1955. (254). The airport was to be supplied with gas for heating, warming-up engines etc. (124).

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54. L'vov

New terminal building was reported in operation in February 1955. It includes a hotel, rest rooms, barber shops, restaurant and service premises. (264).

Other sources reported it under construction in May 1956. (326).

New terminal with a hotel was also reported in September 1956. (229).

The construction of the terminal was criticized for excessive expenditures. (126).

55. Magadan

A new air terminal was reported completed in January 1956. (128).

The passenger turnover in Magadan has greatly increased; the airport is now the 5th among the GVF airports. (164).

56. Magdagachi

57. Magnitogorsk

58. Makhachkala

59. Mary

60. Mineral'nye Vody

A new terminal was reported built in or before February 1955.(254).

61. Minsk

Additional terminal building was planned in February 1955 to be completed by the end of 1956. (260).

The adjacent territory and the approach roads were improved.(229).

The terminal was again reported to be completed by 1956. (192).

62. Molotov

63. Moscow-Bykovo

The terminal was reported to have been designed without due consideration for the flow of passengers. (126).

It is planned to supply the airport with gas for heating, warming-up engines etc. (124).

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64. Moscow-Vnukovo

Chief of the airport: S. Zapylenov (207).

The airport has powerful VHF transmitters for communication with aircraft in the route control zone. The transfer of the transmitters to the international frequency band was in process in June 1956. A relay station was in process of installation somewhere to the west of Moscow, to increase the range of the Moscow Radio Center. The airport is to be supplied with gas for heating, warming-up engines etc. (124).

A hotel was being planned at the airport in February 1955. (260).

A city terminal for the airport was proposed in September 1956, in the former Aeroflot building on Leningradskoye Shosse (229).

Traffic in Vnukovo is considerable (a landing or take-off every 3 or 4 minutes) and the airport administration is being charged with inefficiency and backwardness in applying new techniques, especially in the control of flights. Among other things, mechanization of loading and unloading of aircraft has been urged to cope with the situation. (170).

Chief of the Shipping department: S. Ambroziak. (157).

65. Murmansk

66. Nikolayev

Additional terminal building was planned in February 1955 to be completed by the end of the year (260).

Chief: Yerlykin (169).

67. Nikolayevsk

68. Noril'sk

69. Novosibirsk

New airport terminal was to be opened in February 1955 (254).

Another source reported the terminal under construction in January 1956. (128).

A terminal was further reported to be completed by 1956 (192).

70. Nukus

71. Odessa

A terminal was to be completed by 1956 (192).

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72. Okhotsk

Passenger traffic has considerably increased during 1956. The airport, however, is poorly equipped for adequate service. The demand for air transportation is by far greater than the capacity of the airport (164).

73. Olekminsk

74. Omsk

New airport terminal to be opened in February 1955. (254).

A hotel was planned at about the same time. (260).

The terminal was also reported completed by 1956. (192).

In August 1956, the terminal was criticized for being "too small", and the hotel "tiny" (211); this may be explained by the increased traffic in connection with the introduction of jet airliners (Tu-104), which are scheduled to stop in Omsk on their way to and from Khabarovsk.

75. Pavlodar

76. Pechora

77. Penza

78. Petropavlovsk

79. Riga

New airport terminal was opened in May, 1954 (326). At the moment of signing the documents of delivery, "a number of technical documents arrived from Moscow for the installation of a ventilation system in the completed structure". This was reported in January 1956. (126).

At the same time, the design and construction of the building were criticized for excessive adornments and expenditures. (126).

80. Rostov

The landing system is operated directly from the control tower, without personnel (55).

New airport was built in or before February 1955. (254). The adjacent territory and the approach roads were improved. (229).

Several apartment houses were built in 1954, but by January 1956 they still lacked water supply, sewage etc. (126).

81. Samarkand

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82. **Saratov**

The airport is to be supplied with gas for heating, warming-up engines etc. (124).

83. Semipalatinsk

84. Simferopol'

New terminal was being built in May, 1954, to be completed by 1956. (192, 326).

85. Stalinabad

The airport has summer pavilions, hotels and restaurants. (297).

86. Stalingrad

Chief: Panfilov (56).

The terminal was under construction in January 1956; revision of the project urged (126). The terminal was reported to be completed by 1956 (192).

87. Stalino

An additional terminal building was planned in February 1955, to be completed by the end of the year. (260).

A new beautiful terminal was also reported under construction in September 1955 to be completed by the end of the year. (92).

Another source reports the terminal under construction in January 1956; revision of the project was urged (126).

88. Stanislav

89. Sukhumi

Terminal was to be completed by 1956 (192).

Terminal was further reported under construction in January 1956; revision of the project was urged (126).

90. Sverdlovsk

A new airport terminal was under construction in May 1954. (326).

The completion of the new terminal with a hotel was reported in September 1956. (229).

The adjacent territory of the airport and approach roads were improved. (229).

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91. Syktyvkar

Chief engineer of the operational unit*: Borisevich.

92. Taldy-Kurgan

93. Tallinn

The terminal building of the airport was under reconstruction in June 1952. (319).

An additional terminal building was planned in February 1955 to be completed by the end of the year. (260).

The new terminal was reported completed October 1955. The terminal comprises a spacious lobby with upholstered furniture, a comfortable hotel, snack-bar, waiting and rest room, children's room, post office, telephones, telegraph. (97).

There are 3 military airfields in the vicinity of Tallinn, one of them at Manniku (see list of Airports II) (12).

94. Tashkent

A terminal building was under construction in January 1956; the revision of the project was urged (126, 192).

95. Tbilisi

A new airport terminal was to be opened in February 1955. (254).

96. Termez

97. Tomsk

98. Turkestan

99. Tyumen'

100. Ufa

101. Ukhta

102. Ulan-Ude

A terminal was under construction in August 1955, comprising: a waiting and rest room, post office, savings bank, restaurant, checkroom, and diverse service rooms, (83).

A terminal was to be completed by 1956. (192).

*It appears that the airport constitutes just one operational unit. (Analyst's remark).

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103. Ul'yanovsk

104. Ural'sk

105. Ust'-Kamenogorsk

106. Uzhgorod

107. Velikiye Luki

108. Vil'nyus

A new terminal was being built in May 1954. (326).

A new terminal with hotel was reported in September 1956.(229)

The design and construction of the building were criticized for excessive ornamentation and expenses. (126).

109. Vitim

110. Vladivostok

Deputy Chief of the operational unit* for political affairs:

Tgnatchenko. (67).

111. Vologda

112. Vorkuta

113. Voronezh

114. Voroshilovgrad

115. Yakutsk

The airport has a LERM (250), or a Repair Establishment (107, 250).

Deputy chief for flight service of the Yakutsk operational unit of the GVF (236): A. Snazin. (65).

116. Yanaul

117. Yerevan

A terminal was reported to be completed by 1956 (192).

*It appears that the airport of V. constitutes just one operational unit. (Analyst's remark).

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118. Yuzhno-Sakhalinsk

The equipment of the airport is considered inadequate to service passengers. The turnover of passengers exceeds by far the capacity. (177).

119. Zaporozh'ye

120. Zhdanov (former Mariupol')

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LIST OF AIRPORTS II

The following is a list of airports or airfields not appearing in the 1956 official summer schedules of the Soviet Civil Air Fleet but known from other sources. The list includes airports on local or feeder routes, those operated by the Polar Aviation of the Northern Sea Route, airports formerly participating in all-union networks which have been relegated to local route status or which have been dropped from the current official schedules.

Section A of this list includes airports which appeared on the all-union route charts prior to recent years. The section contains the name of airport and the year of publication of the charts on which the airport appears.

Section B contains the remaining known entries not included in the 1956 official flight schedules, i.e., local and feeder airports, Polar Aviation airports, etc.

Section A

1. Agdam (South-East of Baku).
   Appears on the all-union air route network chart of 1936 (18b).

2. Akhalkalaki (Georgia).
   Mentioned as airport of all-union significance in 1937 and 1939 (11a, 23).

3. Aleksandrovskoye (North of Novosibirsk - Kolpashevo - Kargasok).
   Appears on the all-union air route network chart of 1939 (11a).

4. Ambrolauri (East of Tbilisi).
   Appears on the all-union air route network chart of 1936 (18b).

5. Aral'skoye More* (North tip of the Aral Sea).
   Appears on the all-union air route network chart of 1937 (23).

6. Arkhara (East of Khabarovsk).
   Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

7. Armavir (North Caucasus).
   Known since 1935 (8).
   Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

8. Auliz-Ata (between Tashkent and Frunze).
   Appears on the all-union air route network chart of 1936 (18b).

9. Ayan (between Okhotsk and Nikolayevsk).
   Appears on the all-union air route network chart of 1936 and 1937.
   Last mentioned in 1939 (11a, 18b, 23).

*) Probably former name for the present airport of Aral'sk (Analysts remarks).

10. Balagansk (North of Irkutsk).
Listed as airport of all-union significance in 1937 (23).
[Balashov - See 243]

11. Basargechar (South-West of Baku).
Appears on the all-union air route network chart of 1936 (18b).
Last mentioned in 1939 (11a).

12. Baumanabad (South of Stalinabad).
Appears on the all-union air route network chart of 1936 and 1937 (18a, 18b, 23).

13. Baykit (Krasnoyarsk Kray).
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a).

14. Belorechinskaya (South-West of Rostov).
Appears on the all-union air route network chart of 1936 (18b).

15. Belozersk (North of Cherepovets on the Moscow-Archangel'sk line).
Appears on the all-union air route network chart of 1936 (18b).

16. Berdyansk (West of Zhdanov).
Appears on the all-union air route network chart of 1936 and 1939 (11a, 18a, 18b).

17. Bereznik (South of Arkhangel'sk).
Appears on the all-union air route network chart of 1936 (18b).

18. Bertys (North shore of Balkhash Lake).
Appears on the all-union air route network chart of 1936 (18b, 23)*

19. Biro-Bidzhan (South-West of Khabarovsk).
Appears on the all-union air route network chart of 1936 (11, 18b).

20. Bochkarevo (West of Khabarovsk).
Appears on the all-union air route network chart of 1936 (18b).

21. Bodaybo (South-East of Vitim).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 18b, 23).

22. Bol'sherechenskoye, also Bol'sherech'ye (North of Omsk).
Appears on the all-union air route network chart of 1936 and 1937 (8, 18b, 23).

23. Bryansk (between Moscow and Kiyev).
Appears on the all-union air route network chart of 1936 (18b).
Last mentioned in 1956 (229).

24. Chelkar (South-East of Aktyubinsk).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

25. Chimbay (South of Aral Sea).
Appears on the all-union air route network chart of 1936 (18b).

*) Probably identical with or near to the airport of Balkhash, which name appears in recent schedules for the same location(10).

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26. Dangara (South of Stalinabad).
Appears on the all-union air route network chart of 1936 (18b).

27. Denisovskiy (Between Aktyubinsk and Kustanay).
Appears on the all-union air route network chart of 1937 (23).

28. Dzhetygara (Between Aktyubinsk and Kustanay).
Appears on the all-union air route network chart of 1937 (23).

29. Dzhili-Kul' (South-West of Stalinabad).
Appears on the all-union air route network chart of 1936 (18b).

30. Dzhyardzhin, also Dzhardzhan (North of Yakutsk on the Lena River).
Appears on the all-union air route network chart of 1936 (11).

31. Ekimchan (North-East of Svobodnyy, on the Selemdzha river).
Appears on the all-union air route network chart of 1936, 1937, 1939 (11, 11a, 23).

32. Elista (South of Stalingrad).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

33. Fergana (South-East of Tashkent).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

34. Gagry, also Gagra (between Sukhumi and Sochi).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

35. Gassan-Kuli, also Khasan-Kuli (West of Ashkhabad)
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 18b, 23).

36. Gelendzhik (North-West of Sochi).
Mentioned as airport of all-union significance in 1937 (23).

37. Gruznovskaya, also Gruznovskoye (North of Irkutsk).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

38. Ichera (South-West of Vitim).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

39. Igarka (South of Noril'sk).
Appears on the all-union air route network chart of 1936 and 1939 (11a, 18b).

40. Iletsk (between Ural'sk and Aktyubinsk).
Appears on the all-union air route network chart of 1936, (18b).

41. Iman (North of Vladivostok).
Mentioned as airport of all-union significance in 1937 (23).

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42. (V.) Imbatskoye (South of Noril'sk and Igarka).
Appears on the all-union air route network chart of 1936 and 1939 (11a, 18b).

43. Isitskoye (South-West of Yakutsk).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

44. Kadievka (North-East of Stalino).
Appears on the all-union air route network chart of 1936 (18b).

45. Kalmykovka, also Kalmykovo (between Gur'yev and Ural'sk).
Appears on the all-union air route network chart of 1936 and 1937, (18b, 23).

46. Kamenskoye (North tip of Penzhinskaya Bay, Kamchatka).
Appears on the all-union air route network chart of 1939 (11a).

47. Kamen' (South-East of Novosibirsk).
Appears on the all-union air route network chart of 1936 (11, 18a)

48. Karakol (East of Frunze).
Appears on the all-union air route network chart of 1936 and 1939. (11a, 18b).

49. Kargasok (North of Novosibirsk and Kolpashevo).
Listed in 1935 (8).
Appears on the all-union air route network chart of 1936, 1937 and 1939. (11, 11a, 18b, 23).

50. Karkaralinsk, (East of Karaganda).
Appears on the all-union air route network chart of 1936 and 1937 and 1939 (11a, 18b, 23).

51. Karsakpay (North-East of Dzhusaly).
Appears on the all-union air route network chart of 1936, 1937, and 1939 (11, 11a, 18b, 23).

52. Kazalinsk (between Aktyubinsk and Dzhusaly).
Appears on the all-union air route network chart of 1936 (18b)

53. Kerbi (West of Nikolayevsk and Kerpuchi, Far East).
Mentioned as airport of all-union significance in 1937 (23).
Last mentioned in 1939 (11a).

54. Kerch
Mentioned as airport of all-union significance in 1936, 1937 and 1939 (11, 11a, 23).

55. Kerki (South-West of Tashkent and Samarkand).
Appears on the all-union air route network chart of 1936 (11).

56. Kerpuchi (West of Nikolayevsk).
Mentioned as airport of all-union significance in 1937 (23).

57. Kezhma (East of Krasnoyarsk and Yeniseysk).
Appears on the all-union air route network chart of 1939 (11a)

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58. Khairyuzovo, also Khayryuzovo (West coast of Kamchatka Peninsula opposite Magadan).
Appears on the all-union air route network chart of 1936 (11, 18b).

59. Khodzhent (South of Tashkent).
Appears on the all-union air route network chart of 1936 (18b).

60. Khodzheyli (South of Aral Sea).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

61. Khorog (East of Stalinabad).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 18b, 23).

62. Kirovabad (East of Tbilisi).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

63. Kizyl-Atrek, also Kizil-Atrek, also Kzyl-Atrek (West of Ashkhabad).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

64. Kokand (South-East of Tashkent).
Appears on the all-union air route network chart of 1936 (18b).

65. Kolpashovo (North of Novosibirsk).
Listed in 1936 (8).
Appears on the all-union air route network chart of 1936/1937 and 1939 (11a, 18b, 23).

66. Komsomol'sk/Amur
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 18b, 23). Last mentioned in 1956 (229).

67. Kotlas (On the upper reaches of the Severnaya Dvina).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 18b, 23).

68. Kounrad (North shore of Balkhash Lake).*
Appears on the all-union air route network chart of 1939 (11a).

69. Kramatorskaya (between Stalino and Khar'kov).
Appears on the all-union air route network chart of 1936 (18b).

70. Krivoy Rog (between Dnepropetrovsk and Nikolayev).
Appears on the all-union air route network chart of 1936 and 1937 (11a, 18b, 23). Last mentioned in 1955 in connection with airport libraries. The library of Krivoy Rog contains 26,000 volumes (54).

*) Probably identical with or near the present Balkhash airport.

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71. Kurgan-Tyube (South of Stalinabad).
Appears on the all-union air route network chart of 1936 (18b).

72. Kyzyl-Arvat, also Kzyl-Arvat (West of Ashkabad).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

73. Lar'yan, also Larian (North-East of Tobol'sk).
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a).

74. Lazo (between Khabarovsk and Vladivostok).
Appears on the all-union air route network chart of 1936 (18b).

75. Leninakan (South of Tbilisi).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

76. Lenkoran (South of Baku).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 18b, 23).

77. Leshukonskoye (East of Arkhangel'sk)
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

78. Lodeynoye Pole (East of Leningrad).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11a, 18b, 23).

79. Lugansk (between Voronezh and Rostov).
Appears on the all-union air route network chart of 1936 (18b).

80. Mariinsk'oye, also Mariinsk (Near mouth of Amur River).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11a, 18b, 23).

81. Markovo (North of Kamchatka Peninsula).
Appears on the all-union air route network chart of 1939 (11a).

82. Merv* (North-East of Ashkhabad).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

83. Mestiya (East of Sukhumi).
Appears on the all-union air route network chart of 1936 (18b).

84. Mirzoyan (West of Frunze).
Appears on the all-union air route network chart of 1937 (23).

85. Mogocha (North-East of Chita and Nerchinsk).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

*) Probably identical with or close to the present airport of Mary.

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86. Murgab (East of Stalinabad and Khorog).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 23).

87. Naryn (South of Frunze).
Appears on the all-union air route network chart of 1936 (18b).

88. Nerchinsk (East of Chita).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23, 26).

89. Nor-Bayazet (East of Yerevan).
Appears on the all-union air route network chart of 1936 (18b).

90. Nukha (West of Baku).
Appears on the all-union air route network chart of 1936 (18b).

91. Nukus (South of Aral Sea).
Appears on the all-union air route network chart of 1937 (23).
Last listed in 1954-1955 winter schedules of all-union network*.

92. Nyuya (between Vitim and Olekminsk).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

93. Obdorsk (Southern part of the Ob' estuary).
Appears on the all-union air route network chart of 1936 (18a, 18b).

94. Ol'ga (North of Vladivostok).
Appears on the all-union air route network chart of 1936 (18b).

95. Onega (West of Arkhangel'sk).
Appears on the all-union air route network chart of 1936 and 1939 (11a, 18b).

96. Oni (North-West of Tbilisi).
Appears on the all-union air route network chart of 1939 (11a).

97. Ordzhonikidze (North Caucasus).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

98. Ordzhonikidzegrad (between Moscow and Kiyev).
Appears on the all-union air route network chart of 1937 and 1939 (11a, 23).

99. Orel (Oblast' center).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

100. Orsk (between Aktyubinsk and Kustanay).
Appears on the all-union air route netwcrk chart of 1939 (11a).

101. Osh (South of Frunze and Naryn).
Appears on the all-union air route network chart of 1936, 1937 and

*) AIIR of 7 March 1955, AF 659241, page 25 etc.

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1939 (11a, 18a, 18b, 23).

102. Ostyako-Vogul'sk (North of Tobol'sk).
Appears on the all-union air route network chart of 1939 (11a).

103. Padany (North-East of Petrozavodsk).
Appears on the all-union air route network chart of 1936 on an irregular route from Petrozavodsk to Ukhta (18b).

104. Parkhar (South-East of Stalinabad and Dangara).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

105. Pervomaysk (between Kiyev and Odessa).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

106. Poti (Caucasus, Black Sea shore).
Appears on the all-union air route network chart of 1937 (23).

107. Pudazh (East of Petrozavodsk).
Appears on the all-union air route network chart of 1936 (18b).

108. Roslavl' (South-West of Moscow).
Appears on the all-union air route network chart of 1936 (11).

109. Rugozero (South of Ukhta).
Appears on the all-union air route network chart of 1936 (18b).

110. Rukhlovo (between Chita and Khabarovsk).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11a, 18b, 23).

111. Ryazan' (oblast' center).
Appears on the all-union air route network chart of 1937 (23).

112. Rybach'ye (between Funze and Osh).
Appears on the all-union air route network chart of 1936 (18b).

113. Sergiopol (North-East of Alma-Ata).
Mentioned in 1935 (8).
Appears on the all-union air route network chart of 1936 (18a, 18b).

114. Sergo (East of Voroshilovgrad).
Appears on the all-union air route network chart of 1937 (23).

115. Sevastopol'
Appears on the all-union air route network chart of 1936 (11).

116. Shaartuz (South-West of Stalinabad).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

117. Shala (West of Syktyvkar).
Appears on the all-union air route network chart of 1936 (18b).

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118. Shun'ga (North-East of Petrozavodsk).
Appears on the all-union air route network chart of 1936 (18b).

119. Skadovsk (Kherson oblast').
Appears on the all-union air route network chart of 1936 (18b).

120. Smolensk (oblast' center).
Appears on the all-union air route network chart of 1937 (23).

121. Sovetskaya gavan' (Khabarovsk Kray).
Appears on the all-union air route network chart of 1936 (18b).

122. Stalinogorsk (between Voronezh and Moscow).
Appears on the all-union air route network chart of 1936 (18a, 18b).

123. Starobel'sk (South of Voronezh).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11a, 18b, 23).

124. Svobodnyy (North-West of Khabarovsk).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 23).

125. Tamdy (West of Tashkent).
Appears on the all-union air route network chart of 1937 (23).

126. Tara (North of Omsk).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23). Known since 1934 (8).

127. Tashauz
Appears on the all-union air route network chart of 1936 and 1937 (18a, 18b, 23, 11).

128. Temir (between Gur'yev and Aktyubinsk).
Appears on the all-union air route network chart of 1936 (18b).

129. Troitsko-Pechorskoye (East of Syktyvkar).
Appears on the all-union air route network chart of 1939 (11a).

130. Tsipikan (North of Chita).
Appears on the all-union air route network chart of 1936 (11).

131. Tuapse (North-West of Sochi).
Appears on the all-union air route network chart of 1937 (23).

132. Tura (East of Turukhansk on Yenisey River).
Appears on the all-union air route network chart of 1936 (11).

133. Turtkul' (East of Tashauz and Urgench).
Appears on the all-union air route network chart of 1936 and 1937 (18a, 18b, 23).

134. Tygda (between Chita and Khabarovsk).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

135. Uil (between Gur'yev and Aktyubinsk)
Appears on the all-union air route network chart of 1936 (18b).

136. Uryupinsk, also Uryupino (between Stalingrad and Vozonezh).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

137. Ustyuzhna (North of Moscow).
Appears on the all-union air route network chart of 1936 (18b).

138. Ust'-Kolyma (mouth of Kolyma River).
Appears on the all-union air route network chart of 1936 (11).

139. Ust'-Bol'sheretsk (Kamchatka Peninsula South-West).
Appears on the all-union air route network chart of 1936 and 1939 (11a, 18b).

140. Ust'-Kut (North of Irkutsk on route to Yakutsk).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

141. Ust'-Olenek (mouth of Olenek River).
Appears on the all-union air route network chart of 1936 (11).

142. Ust'Tsil'ma, also Ust'-Tsyl'ma (South of Nar'yan-Mar, White Sea).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 18b, 23).

143. Ust'-Usa (South-East of Nar'yan-Mar, White Sea).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 18b, 23).

144. Ust' Yeniseyskiy Port (Mouth of Yenisey River near Dudinka).
Appears on the all-union air route network chart of 1936 and 1937 (11, 23).

145. Vytegra (Southern tip of Onega Lake).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11, 11a, 18a, 18b, 23).

146. Yalta (Crimea Peninsula).
Appears on the all-union air route network chart of 1937 (23).

147. Yartsevo (North of Krasnoyarsk).
Appears on the all-union air route network chart of 1939 (11a).

148. Yelets (between Vosonezh and Moscow).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

149. Yevlakh (West of Baku).
Appears on the all-union air route network chart of 1936 and 1939. (11a, 18a, 18b).

150. Zakataly (West of Baku and Yevlakh).
Appears on the all-union air route network chart of 1936 and 1939 (11a, 18a, 18b).

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151. Zaliv Kresta (Chukotsk Peninsula).
Appears on the all-union air route network chart of 1939 (11a).

152. Zverinogolovskiy (South-East of Chelyabinsk).
Appears on the all-union air route network chart of 1939 (11a).

Section B

153. Abakan (Center of autonomous oblast, south of Krasnoyarsk).
Last mentioned in 1955 (58, 303).

154. Agdali (Transcaucasus).
Mentioned in 1936 (18a), as having air connection to Yevlakh (which see).

155. Aleksandrov
Industrial center, on air route from Moscow to Vladimir, opened Oct 17, '56. (286).

156. Aleksandrovsk-Sakhalinskiy
The route Khabarovsk - Aleksandrovsk-Sakhalinskiy was initiated in 1930 by M. V. Vodop'yanov (310a). Appears on the all-union air route network chart of 1936 (18b). Mentioned in 1939 (11a). Within the last 5 years, freight & passenger transport on this line has been considerably increased. Last mention in 1955. (58).

157. Alitus (Near the town of Alitus, Lithuania).
Known to be used occasionally for Li-2 planes in or about 1951 (252).

158. Allaikha, also Allaika (On the lower reaches of Indigirka River).
Appears on the all-union air route network chart of 1936 (11), and on the Polar Aviation air route network chart of 1937 (23).

159. Amderma (Coast of Kara Sea).
Appears on the Polar Aviation network chart of 1937 (23). Appears on the all-union air route network chart of 1939 (11a).

160. Anadyr' (Chukotsk Peninsula, mouth of Anadyr' River).
Appears on the major air route chart and Polar Aviation air route chart of 1936 and 1937 (11, 23). Appears on the all-union air route network chart of 1939 (11a). Last mentioned in 1955 (58).

161. Andizhan (between Tashkent and Osh).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23). Last mentioned in 1956 (177).

162. Aste (On the island Saaremaa, Estonia).
A larger airfield. Last mentioned in 1949 (12).

163. Bakhty (North-East of Alma-Ata).
Mentioned in 1935 (8).
Appears on the all-union air route network chart of 1936. (18a, 18b).

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164. Baunt (North of Chita).
Last mentioned in 1939 (11a).

165. Berezovo (On the left bank of Sos'va, tributary of Ob' River).
Appears on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network of 1936 and 1939 (11, 11a, 18b).

166. Biny
Air gateway to Baku, one of the largest airports in the country. Its modern equipment allows planes to land and take-off at night, in fog and under any weather conditions. Last mentioned in 1955 (257).

167. Biryuza also Biryusa (South-West of Nizhneudinsk).
There were two airfields in operation in 1937: The Biryuza Gold Mines and the Biryuza Mica Mines. Twenty planes were operating on the line Nizhneudinsk-Biryuza. The airfield at Gold Mines is situated in a gorge with a small runway. At Mica Mines the landing place was close to the Warehouses. (333a).
Appears on the all-union air route network of 1939 (11a).

168. Brest
Last mentioned in 1955 (58).

169. Bukhta Provideniya (Extreme East of the Chukotsk Peninsula).
Appeared on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network of 1936 and 1939 (11, 11a).

170. Bukhta Tikhaya (Franz Josef Land).
One or more unnamed airfields appear to exist in the archipelago of Franz Josef Land, probably near Polar Stations (Rudolf Island, Bukhta Tikhaya), according to the "main air route" charts of 1936 and 1939 and of air routes of the Northern Sea Route of 1937 (11, 11a, 23).

171. Dikson (Mouth of Yenisey River).
Appeared on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a).

172. Dudinka, also Dudinskoye (West of Noril'sk).
Appeared on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1936 and 1939 (11a, 18a, 18b).

173. Dzharkent (East of Alma-Ata).
Appears on the all-union air route network chart of 1936 and 1937 (1, 18a, 18b, 23).

174. Garm (East of Stalinabad).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23). The airport was improved in 1955 (297).
Daily flights to Stalinabad started in April, 1955 (296).

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175. Gizhiga (Tip of the Gizhiginskaya Guba)
Appeared on the Polar Aviation air route chart of 1937 (23).

176. Grodno
Flights to Minsk maintained in summer 1956. (236).

177. Ivanovo (East of Moscow).
Daily flights from Moscow-Bykovo, starting May 1956 (221, 229, 333).

178. Kagan (Bukhara oblast')
Mentioned in 1936 (18a)

179. Kalinin
Mentioned in 1956 (229).

180. Kaluga
Last mentioned in 1956 (229).

181. Karmelovka (Near Kaunas, Lithuania).
Known to have been used very intensely in 1951, about 150 2-engine planes having been statinned there (252).

182. Karujarve. (On the island Saaremaa, Estonia).
An Airfield and a seaplane base. Last mentioned in 1949 (12).

183. Kazach'ye (Right bank of lower reaches of Yana River).
Appears on the all-union air route network chart of 1936 (11).
Appeared on the Polar Aviation air route chart of 1937 (23).

184. Khasan-Kuli. See Gassan-Kuli.

185. Khatanga (right bank of Khatanga estuary)
Appeared on Polar Aviation air route chart of 1937 (23).

186. Khiva (from Urgench).
Known in operation in and before 1936 (18a)

187. Kingisepp, former Kuresaare (On the island Saaremaa, Estonia)
Last mentioned in 1949 (12).

188. Kol'chugino (between Moscow and Vladimir).
Industrial center, on the route from Moscow to Vladimir; traffic opened October 17, 1956 (286).

189. Kolpashovo (North of Novosibirsk).
Listed in 1935 (8).

190. Kol'tsovo (Sverdlovsk oblast').
Known to be in operation in 1955 (41). Last mentioned in 1956 in connection with replacement of the homing radio beacon (206).

191. Kostroma (Oblast' center).
Last mentioned in 1956 (229).

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192. Kulyab (South-East of Stalinabad)
Appears on the all-union air route network chart of 1936 and 1937 (18a, 18b, 23). Improved in 1955 (297). Daily flights to Stalinabad started in April 1955 (296).

193. Kuznetsk (from Novosibirsk).
Known in operation in and before 1936 (18a).

194. Kyzyl (Capital of the Tanu-Tuva autonomous oblast').
Known since 1937 (23). Had air connections via Abakan to Krasnoyarsk in 1954 (253, 303).

195. Liepaja (Latvian SSR).
Airfield is located in the Northern suburb of the city. Its Western boundary is formed by the outer harbor, the Northern by the Canal of the Naval Port (8a). Daily flights between Riga and Liepaja were opened in June, 1946 (316a).

196. Lipetsk (Oblast'center).
Air connection to Moscow was scheduled in May 1956 (333).

197. Manniku (South of Talinn Estonian SSR).
A strictly isolated and heavily guarded area, surrounded by enclosures of barbed wire and a high fence (12).

198. Matochkin Shar (Islands of Novaya Zemlya).
An unnamed airfield existed near the Matochkin Shar Sound, according to the charts of main air routes in 1936 and 1939 (11, 11a). Appears on the Polar Aviation network chart of 1937 (23).

199. Muynak (South-West Shore of the Aral Sea).
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a, 18b).
Last mentioned in 1955 as 3rd prize winner in the all-union competition of airports (311).

200. Mys Chelyuskin (Taymyr Peninsula).
Appears on the Polar Aviation air route network chart of 1937. The air routes from Mys Chelyuskin proceed further northward along the East shores of the Severnaya Zemlya Archipelago. The location and names of airfields are not shown (23).
Appears on the all-union air route network chart of 1939 (11a).

201. Mys Nordvik (Mouth of Khatanga River).
An unnamed airfield appears to exist at Mys Nordvik, possibly on Mys Paksa, according to the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a).

202. Namangan (South-East of Tashkent).
Appears on the all-union air route network chart of 1936 (18b).
Last mentioned in 1956 (177).

203. Mys Shmidta (North shore of Chukotsk Peninsula).
Appears on the Polar Aviation air route chart of 1937 (23).

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204. Appears on the all-union air route network chart of 1936 and 1939 (11, 11a).

204. Mys Zhelaniya (North of Novaya Zemlya).
Appears on the all-union air route network chart of 1936 (11).
Appears on the Polar Aviation air route chart of 1937 (23).

205. Nar'yan-Mar (East of Arkhangel'sk).
Appears on the all-union air route network chart of 1937 and 1939 (11a, 18b, 23). Often mentioned in connection with Polar Aviation.

206. Nezametnyy (South of Yakutsk and Olekminsk).
Appears on the all-union air route network chart of 1937 and 1939 (11a, 23).

207. Nizhne-Udinsk (between Krasnoyarsk and Irkutsk).
Appears on the all-union air route network chart of 1936, 1937 and 1939 (11a, 18b, 23). Base airport for the Tofalaria area and for forestry and agricultural aviation in 1956 (147).

208. Nogayevo, also Nagayevo (near the city of Magadan).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23). At present probably one of the airports serving the city of Magadan.

209. Novaya Zemlya, Islands.
An unnamed airfield may exist on the Western shore of the Northern Island, according to a chart of main air routes of 1939 (11a).

210. Novyy Port (West bank of the Ob' estuary).
Appears in the Polar Aviatinn air route chart of 1937 (23).
Appears in the all-union air route network chart of 1936 and 1939
211. (11, 11a).

211. Okha, also Okhe (near the Northern tip of Sakhalin Island).
Appears on the all-union air route network chart of 1936 and 1937 (11a, 18a, 18b). Last mentioned in 1955 (49, 58).

212. Olenek (On or near the Olenek River).
One of the airports of the Yakutsk operational unit. Air connection from Zhigansk in 1955 (65).

213. Oymyakon, also Oymekon (North-East of Yakutsk).
Marked on main air route chart of 1939 as having irregular passenger service on the route from Yakutsk to Anadyr' (11a). Mentioned again in 1956 (324).

214. Pärnu (Seashore resort, Estonian SSR).
There are two airfields in the area, one near the town, the other further southwest. Used by Air Force (12).

215. Pekhlevi (from Baku).
Known in operation in and before 1936 (18a).

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216. Petropavlovsk/Kamchatka.
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a, 18b). Mentioned again in 1955 (58).

217. Petrozavodsk.
Appears on the all-union air route network chart of 1936 (11, 18b).
Listed in 1954-1955 winter schedules of all-union network.*

218. Podkamennaya Tunguska (North of Krasnoyarsk).
Appears on the all-union air route network chart of 1936 probably under the jurisdiction of the Northern Sea Route (GUSMP) (18b).

219. Poltsamaa (in Russian transliteration Pyl'tsama).
The airfield is located near the town of Poltsamaa, Estonian SSR. Used by Air Force (12).

220. Prokop'yevsk (420 km South of Novosibirsk).
Known to operate in 1936 (18a).

221. Provideniya, Bukhta, see Bukhta Provideniya.

222. Rider (connection to Semipalatinsk).
Known in operation in and before 1936 (18a).

223. Russkoye Ust'ye (Mouth of Indigirka River).
Appears on the Polar Aviation air route chart of 1937 (23).

224. Salegard, also Salekhard (Right bank of lower reaches of Ob' River).
Appears on the Polar Aviation air route network chart of 1937, as the northernmost terminal of the route from Tyumen' (23).

225. Samarovo (North of Tobol'sk).
Appears on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1936 (11, 18b).

226. Sar'yan Paul' (West of Berezovo).
Appears on the all-union air route network chart of 1936 as the terminal of a branch route from Berezovo (11).

227. Sernyy, also Sernyy Zavod (North of Ashkhabad).
Serving the Kara-Kum Sulphur Mines.
Appears on the all-union air route network chart of 1936 and 1937 (18a, 23). Last mentioned in 1956 (240).

228. Seymchan (North of Magadan, on Kolyma River).
Appears on the all-union air route network chart of 1936 (11).
Appears on the Polar Aviation air route chart of 1937 (23).

229. Shchelkovo (Near Moscow).
Known as one of the Moscow airfields in 1937 (22).

230. Shcherbakov (at the exit of the Volga River from the Rybinsk reservoir).
Mentioned in 1956 (229).

*) AIIR of 7 March 1955, AF 659241, page 21 etc.

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231. Somera (On the island Saaremaa, Estonian SSR)
A larger airfield, mentioned in 1949 (12).

232. Sovetskiy Rudnik (North of Yeniseysk).
Appears on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1939 (11a).

233. Sredne-Kolymsk (On the Kolyma River).
Appears on the Polar Aviation air route chart of 1937 (23).

234. Takhtamygda (near Rukhlovo, between Chita and Khabarovsk).
Appears on the all-union air route network chart of 1936.
From Takhtamygda air connection branched off to Yakutsk (11).

235. Tartu.
One of the largest airfields in Estonian SSR. Used by Air Force (12).

236. Tavda (North of Sverdlovsk).
Appears on the Polar Aviation air route chart of 1937 (23).

237. Tiksi (near the mouth of Lena River).
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a). Appears on the Polar Aviation air route chart of 1937 (23). Air connection from Yakutsk was maintained in 1956 (324).

238. Tobol'sk
Appears on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1936 (10, 11, 11a, 18b).

239. Tofalariya (South of Irkutsk, area inhabited by Tofa).
Air connection was maintained with the area in 1956 from Nizhne-Udinsk (147). The exact location of the airfield is not known.

240. Turinskaya Kul'tbaza (South-East of Turukhansk).
Appears on the Polar Aviation chart as terminal of a branch of the Krasnoyarsk-Dudinka route under the jurisdiction of the Northern Sea Route of 1937 (23).
Appears on the all-union air route network chart of 1939 (11a) and of 1936 under the name Tura (11).

241. Turukhansk (South of Dudinka on Yenisey River).
Appears on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a).

242. Tushino (North-Western outskirts of Moscow).
An airport well known as the place for public air shows.

243. Balashov (Oblast center, South-East of Moscow).
Air connection to Moscow. Last mentioned in 1956 (274).

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244. Uellen (Northernmost point of the Chukotsk peninsula).
Appears on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a).

245. Urgench, also N. Urgench.
Appears on the all-union air route network chart of 1936, 1937, 1939 (11a, 18b, 23). Mentioned again in 1956 (177).

246. Ust'-Nera (Yakutsk oblast').
Mentioned in 1956 (132).

247. Vashki (West of Syktyvkar).
Appears on the all-union air route network chart of 1936. Vashki was the North-Eastern terminal of a separate Ustyuzhna-Vashki route. (18b).

248. Vaygach Island (Kara Sea).
Appears on the all-union air route network chart of 1936 and 1939 (11, 11a). The exact location of the airfield (or airfields) is not known.

249. Ventspils (Latvian SSR).
Daily flights between Riga and Ventspils opened in June, 1946 (316a).

250. Verkhne-Kolymsk (on the upper reaches of Kolyma River).
Appears on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1939 (11a).

251. Verkholensk (North of Irkutsk).
Appears on the all-union air route network chart of 1936 and 1937 (18b, 23).

252. Verkhoyansk (right bank of the Dulgalakh River).
Appears on the Polar Aviation air route chart of 1937 (23).

253. Vilyuysk (West of Yakutsk).
Appears on the all-union air route network chart of 1939 (11a).

254. Vitebsk
Mentioned in 1956 (223).

255. Vladimir (oblast' center). Local air route to Kol'chugino and Aleksandrov opened October 17, 1956. Air link with Moscow was established about the same time. (286). Summer 1956 - routes operating to Gor'kiy and Yaroslavl' (236).

256. Vrangel' Island (off North shore of Chukotsk Peninsula).
Appears on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1939 (11a).

257. Yakutsk.
Appears on the Polar Aviation air route chart of 1937, as the starting point of the air route to Tiksi (23). In 1939 and thereafter the route appears on the all-union air route network charts (10, 11a, etc.)

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258. Yaroslavl' (oblast center).
Air routes were opened from Yaroslavl' to other cities in summer 1956. Route Yaroslavl' - Gor'kiy opened on August 1, 1956, Yaroslavl' - Moscow - on August 2, 1956 (236, 318).

259. Yeniseysk (North of Krasnoyarsk).
Appears on the all-union air route network chart of 1936, on the route to Dudinka-Norilsk, which apparently was operated by the Northern Sea Route (GUSMP) (186) and subsequently on a chart of 1939 (11a). Last mentioned in 1956 (221).

260. Zhigansk (North of Yakutsk on Lena River).
Appears on the Polar Aviation air route chart of 1937 (23).
Appears on the all-union air route network chart of 1939 (11a).
In 1955, belonged to the Yakutsk operational unit of the Aeroflot; air connection to Olenek (65).

261. Zyryanka (Yakutsk Autonomous SSR).
Mentioned in 1956 (324).

262. Zyryanovskoye (South-East of Semipalatinsk).
Appears on the all-union air route network chart as the southern terminal of a detached Semipalatinsk-Zyryanovskoye air route, 1939 (11a).

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45.			
46.			
47.	Ibid.	#5	p.1
48.	Ibid.		p.2-3
49.	Ibid.		p.9
50.	Ibid.		p.10
51.	Ibid.		p.11
52.	Ibid.		p.17
53.	Ibid.		p.33
54.	Ibid.		p.34
55.	Ibid.	#6	pp.1-3
56.	Ibid.		pp.7-8
57.	Ibid.		p.12
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59.	Ibid.	#7	pp.1-2

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60.	Grazhdanskaya Aviatsiya (Civil Aviation) 1955 #7		pp.3-4
61.	Ibid.		pp.5-6
62.	Ibid.		p.8
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64.	Ibid.		p.11
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66.	Ibid.		p.17
67.	Ibid.		p.18
68.	Ibid.		p.23-24
69.	Ibid.		p.27
70.	Ibid.		pp.28-29
71.	Ibid.		p.30
72.	Ibid.		p.31
73.	Ibid.		pp.32-34
74.	Ibid.		pp.35-36
75.	Ibid.		pp.37-38
76.	Ibid.	#8,	pp.1-2
77.	Ibid.		pp.3-5
78.	Ibid.		p.10
79.	Ibid.		p.13-14
80.	Ibid.		p.30
81.	Ibid.		pp.33-34
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89.	Ibid.		p.28
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97.	Ibid.		p.34
98.	Ibid.	#11	p.2
99.	Ibid.		p.7
100.	Ibid.		p.9
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104.	Ibid.		p.30
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107.	Ibid.	#12	front
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252.	Newsletter From Behind the Iron Curtain No.244/45, Sept. 1951				p.197
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256.	Bakinskiy Rabochiy	1955	#104	May 4	p.2
257.	Ibid.		#156	July 3	p.3
258.	Ibid.	1956		Aug 9	p.4
259.	Izvestiya	1955		Jan 27	p.3
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270.	Izvestiya	1956		Jan 5	p.2
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296.	Kommunist Tadzhikistana	1955	May 13	p.4
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316.	Sovetskaya Kirgiziya	1956	Aug 9		p.3
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325.	Turkmenskaya Iskra	Jun 26	pp.1-3
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333a.	Vostochno-Sibirskaya Pravda	1937, June 5	p.4
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Fig. 1. (coord. unknown). Cat: 611. Il-14 airliner. Source: Grazhdanskaya Aviatsiya, #7, 1956 (AF1031215) bottom, p. 37.

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Fig. 2. USSR. (coord. unknown). Cat: 611. Tu-104 jet airliner navigator's cabin. Source: Grazhdanskaya Aviatsiya, #5, 1956, inside front cover #(3). bottom right.

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Fig. 3. USSR. (coord. unknown). Cat: 611. Helicopter Mi-4.
Source: Grazhdanskaya Aviatsiya, #8, 1956. back cover.

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Fig. 4. USSR. 50.27N-30.32E; Kiev. Cat: 612. Aircraft repair base, flow method of engine assembly. Source: Grazhdanskaya Aviatsiya, #8, 1955 (AF683567), p. 3, top.

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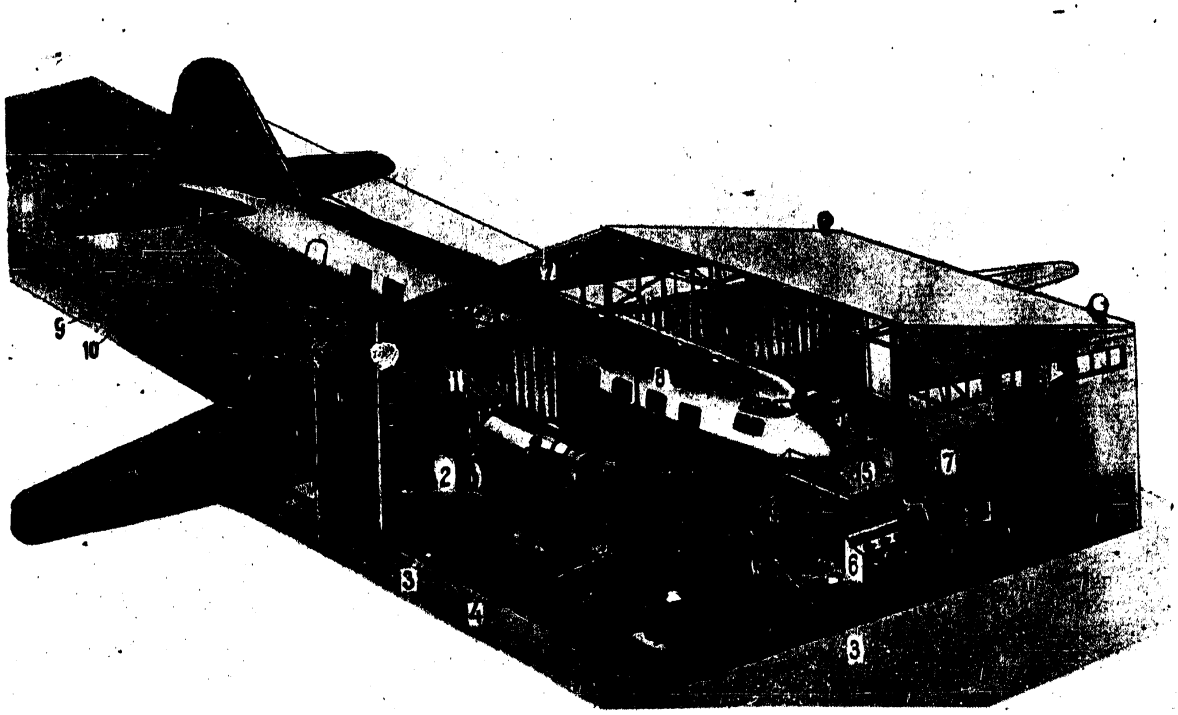

Fig. 5. USSR. (coord. unknown). Cat: 610. Dock Project. Source: Grazhdanskaya Aviatsiya, #10, 1956, p. 23.

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Fig. 6. USSR. (coord. unknown). Cat: 402. Central laboratory of a repair establishment. Source: Grazhdanskaya Aviatsiya, #2, 1956 (AF726662), p. 27, top.

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Fig. 7. USSR. 46.58N-142.44E; Yuzhno-Sakhalinsk. Cat: 527. Flight control in the airport. Source: Grazhdanskaya Aviatsiya, #9, 1956, upper left #(4), p. 21.

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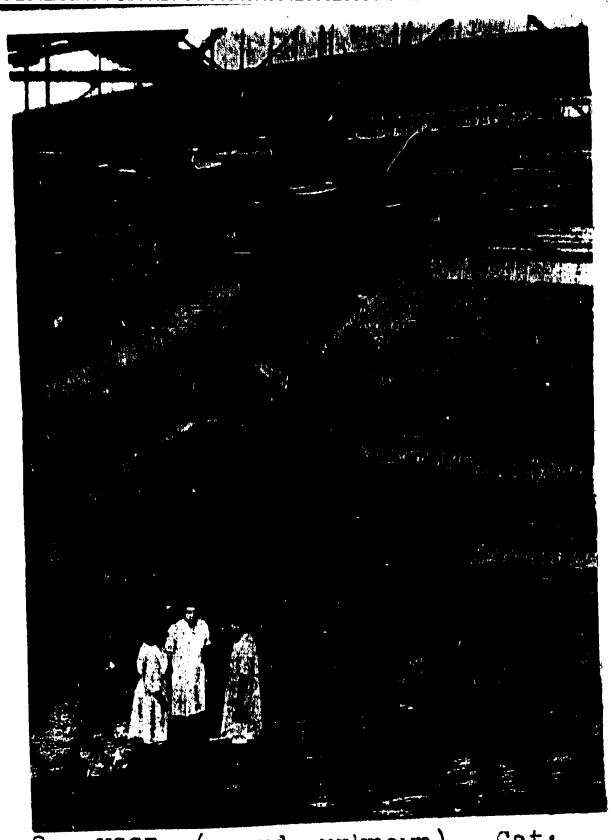

Fig. 8. USSR. (coord. unknown). Cat: 611. LERM - Flow line in an assembly shop. Source: Grazhdanskaya Aviatsiya, #10, 1956, p. 31.

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Fig. 9. USSR. (coord. unknown). Cat: 611. LERM - engine assembly line. Source: Grazhdanskaya Aviatsiya, #10, 1956, p. 30.

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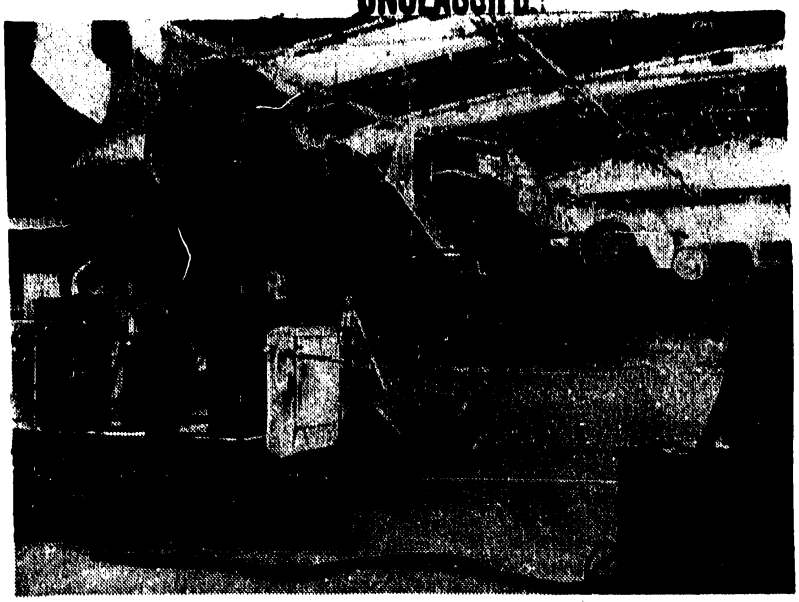

Fig. 10. USSR. (coord. unknown). Cat: 306. Transportable X-ray installation. Source: Grazhdanskaya Aviatsiya, #9, 1956, bottom p. 27.

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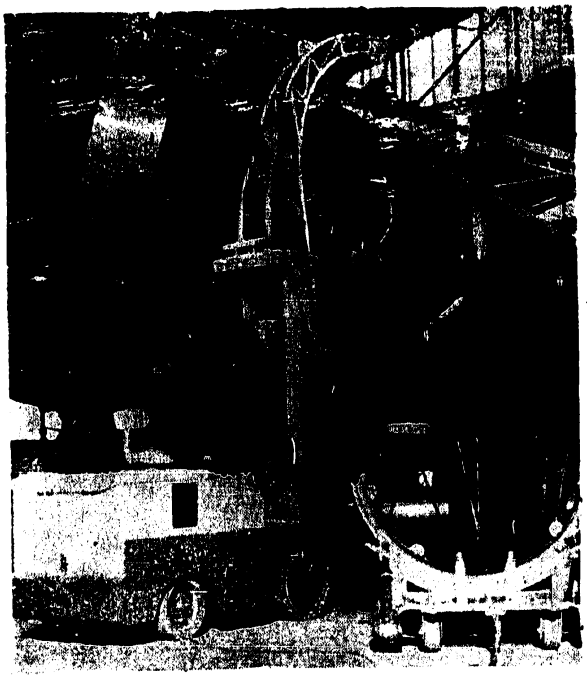

Fig. 11. USSR. (coord. unknown). Cat: 610. Installation of engine in the aircraft. Source: Grazhdanskaya Aviatsiya. #8. 1956, upper p. 35.

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Fig. 12. USSR. (coord. unknown). Cat: 527. A control tower operator (flight controller) in one of the Far Eastern airports. Source: Grazhdanskaya Aviatsiya, #10, 1956, inside front cover.

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Fig. 13. USSR. 55.37N-38.04E; Bykovo. Cat: 611. Towing an aircraft at the airport. Source: Grazhdanskaya Aviatsiya, [redacted] STAT

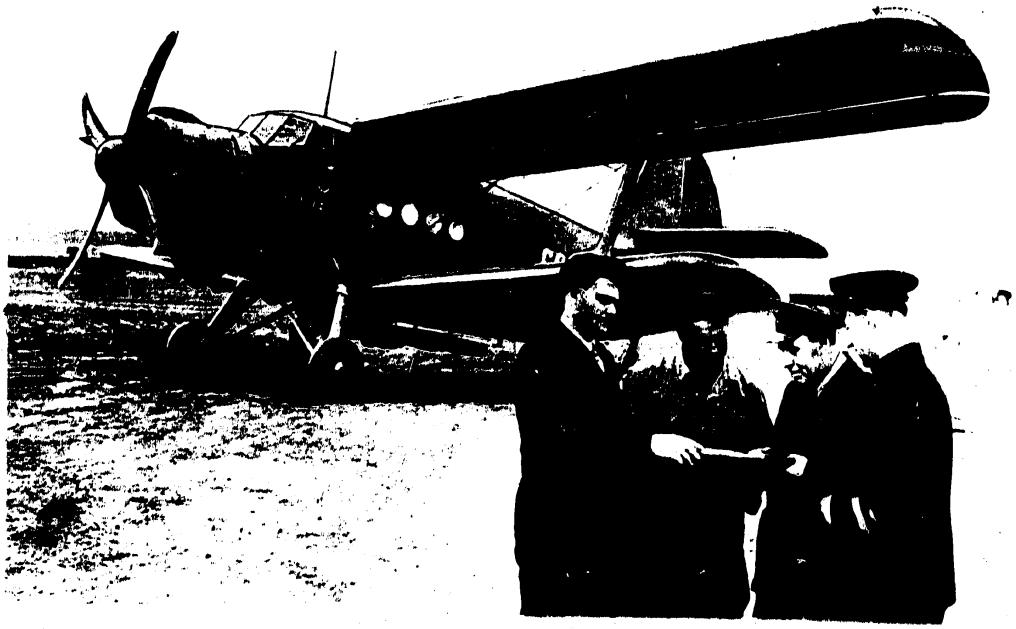
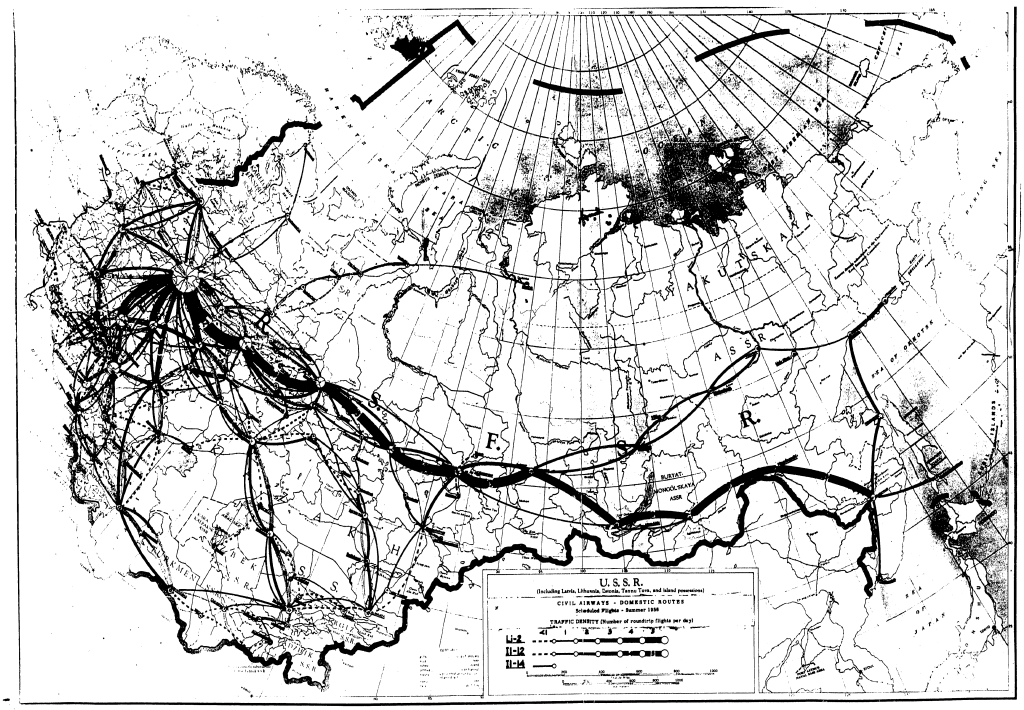


Fig. 14. USSR. Coord. Unknown. Slobodzeysk rayon, Moldavian SSR. Cat: 810; 610. An-2 agricultural type aircraft. Source: Grazhdanskaya Aviatsiya, [redacted] STAT inside front cover.

[redacted] STAT



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